Water Quality Status Based on Physicochemical Parameters of Some Rivers in West Bengal, India

Sanjay Dey and Ashis Kumar Panigrahi

C A R A S

Full Length Research Article

Water Quality Status Based on Physicochemical Parameters of Some Rivers in West Bengal, India

Sanjay Dey*[1,2] and Ashis Kumar Panigrahi[2]

A B S T R A C T

Various industries water seriously affect river water as it directly falls in the river. WHO indicates that the effects of pollution are an indicator of the quality of water. Water quality indicates that river water is deteriorated by many organic contaminants. Domestic wastes, irrigation are other causes of river pollution. West Bengal has many rivers. Bhagirathi Hooghly is a prime river. Some important rivers are Teesta, Damodar, Rupnarayan, Ajay, Mayurakshi. Periodic evaluation of water quality is necessary for improving water. To maintain water quality, monitoring programs must be essential. The Pollution status of water is mainly measured by WQI. This paper shows the water quality parameters of Rivers in West Bengal.

Key words: Bioindicator, Precipitation, Geochemistry, Urbanization, Permissible

Ocean and river are crucial sources of more than 90% of water use satellite images for water quality parameters [1-2]. In river water benthos act as bioindicators [3]. To investigate water level fluctuation PCA/PFA techniques were commonly used [4]. Several studies indicate that parameters need to be chosen in rational ways [5]. The concentration of pollutants increases due to interception and precipitation [6]. Environmental geochemistry-related pollution was studied [7]. Urbanization and industrialization are the chief cause of river pollution [8]. Sometimes high pollution occurs by anthropogenic activities [8]. Cd, Cr, Pb in water samples were analyzed [9]. Some researchers such as suggested that sediments of the river are contaminated by metals specifically heavy metals [10]. Mahanadi and Brahmani river's average discharge is 0.047 million cubic meters /km^2 [11]. Another cause of river water quality changes is solid waste dumping and metal salts [12]. Most of the rivers in Bengal are facing a high amount of pollution. Leaching of fertilizer caused water pollution [13].

MATERIALS AND METHODS

An Immense review has been done to identify the pollution status of some key rivers in West Bengal. Scientific data has been collected from reputed national and international journals. Scopus indexed journal was prioritized to integrate the manuscript. Precedence has been done on the recent publication of scientific articles regarding river pollution. The Selection of key words was done by scientific approaches. Extensive result analysis of some rivers was done by several research papers.

Water quality parameters

Temperature: High temperature reduces dissolved oxygen that is harmful to organisms. Some research showed industries polluted water shows warmer than other water.

Dissolved oxygen: Some scientists showed DO levels below 1 mg/l cause mortality of fish. In running water saturation of atmospheric oxygen is more than confined water [14].

Alkalinity: Alkalinity is another factor in water quality. [15] reported alkalinity was high in summertime and minimum in wintertime. [16] reported Carbon dioxide to remove from bicarbonate increase the alkalinity of water.

Hardness: Hardness is the presence of metal ions that comes from minerals in the water. Many toxic elements influence water hardness [17]. Measurement of hardness by calcium, magnesium. The Hardness comes about due to metals cations.

pH: pH is used for knowing the nature (acidic or basic) of the solution. Lower pH indicates acidic. Higher pH indicates more basic.

TDS: TDS indicates dissolved substance concentration in solids. Research showed if TDS concentration increases in water, sometimes it does not affect health.

* **Sanjay Dey**
✉ sanjaydey2116@gmail.com

1 Department of Zoology, Ananda Mohan College, Kolkata - 700 009, West Bengal, India

2 Eco- toxicology, Fisheries and Aquaculture Extension Laboratory, Department of Zoology, University of Kalyani, Nadia - 741 235, West Bengal, India

Res. Jr. of Agril. Sci. (Jan-Feb) **13**(1): 231–234

232

Bhagirathi Hooghly river

Microbiological and physicochemical analysis in the Hooghly River of Naihati was done from January 2010 to December 2010 [18]. According to [18] mean Temperature was 23.4 °C, mean Dissolved Oxygen was 5.94 mg/l, mean Total Dissolved Solids was 402.66 mg/l, mean BOD was 8.47 mg/l at Naihati in the river of Bhagirathi Hooghly. Variation of Dissolve Oxygen in Berhampore was 6.983 mg/l to 7.658 mg/l, Palta was 6.044 mg/l to 7.45 mg/l, Srirampore was 6.225 mg/l to 7.815 mg/l, Shibpur was 5.65 to 6.926 mg/l, Garden Reach was 5.78 mg/l to 6.771 mg/l, Dakhshineswar was 5.919 mg/l to 6.373 mg/l, Uluberia was 5.733 mg/l to 6.285 mg/l, Diamond Harbour was 6.051 mg/l to 6.88 mg/l [19].

Mayurakshi river

Water quality in the Mayurakshi river was studied by researcher [20]. Eleven sampling sites were selected in the Mayurakshi river of West Bengal [20]. pH range in Mayurakshi river varies from 7.12 to 7.95, Total Dissolved Solids range in Mayurakshi river varies from 155.53 mg/l to 231.14 mg/l, Dissolved Oxygen range in Mayurakshi river varies from 4.43 mg/l to 7.28 mg/l [20].

Ichamati river

River Ichamati begins from Majdia [21]. Nine sampling stations of Ichamati River were chosen for water quality, namely, Majhdia, Naghata, Papul Baria, Bongaon Bridge, Old Bongaon Kalitala, Kalanchi Bridge, Tentulia Bridge, Bashirhat Bridge, Taki [21]. In Pre-monsoon dissolved oxygen was 6.23

mg/l in Majdia, in monsoon, it was 5.7 mg/l, and post-monsoon was 5.6 mg/l [21]. Taki showed the highest temperature that was 34.5°C [21].

RESULTS AND DISCUSSION

Graphical representation showed variation among different parameters of rivers water. Mean dissolved oxygen (ppm) in the Sutunga River was shown in (Table 1). Average PH and TDS (mg/l) in Damodar River were exhibited in (Fig 1-2. The Salinity of Ichamati river in different sites were shown in (Fig 3-4) represented the maximum and minimum Ca 2^+ in the Damodar river in 2007 and 2008. Box plot of EC in the Ajay River was shown in (Fig 5). Mean BOD (ppm) in the Sutunga river was shown in (Fig 6). Mean dissolved oxygen (ppm) in the Raidak river was shown in (Fig 7). Mean physicochemical parameters in the Mayurakshi river was shown in (Fig 8). Cluster analysis of physicochemical parameters of seven sites in the Ajay river was shown in (Fig 9).

Table 1 Mean dissolved oxygen (ppm) value in Q1 (Jamaldah), Q2 (College More), QIII (Manabari) in Sutunga river [22]

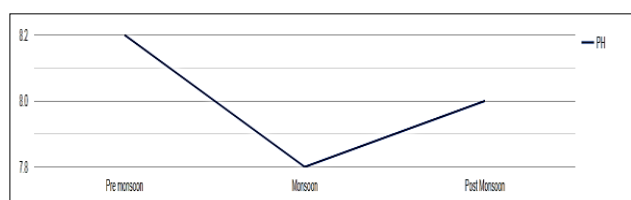|	Pre-monsoon	Monsoon	Post-monsoon
Q1 (Jamaldah)	5.7	6.9	4.2
Q2 (College More)	4.94	5.02	3.38
Q3 (Manabari)	4.9	5.6	3.5

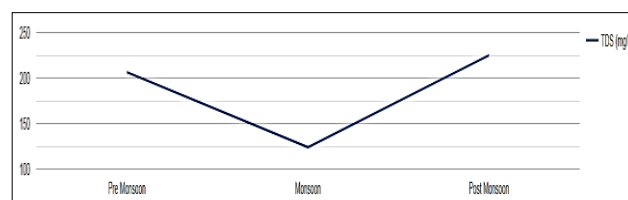Fig 1 Average pH in Damodar River in 2007 [23]

Fig 2 Average TDS (mg/l) in Damodar River in 2007 [23]
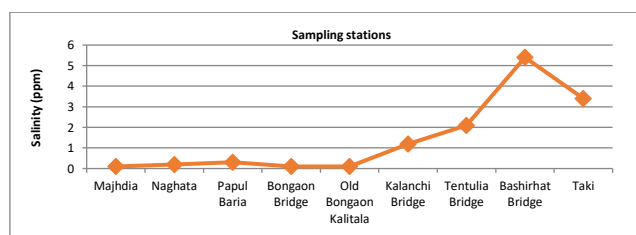

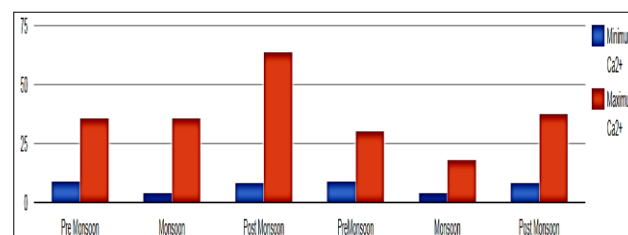Fig 3 Salinity of different sites in Monsoon in Ichamati river [21]

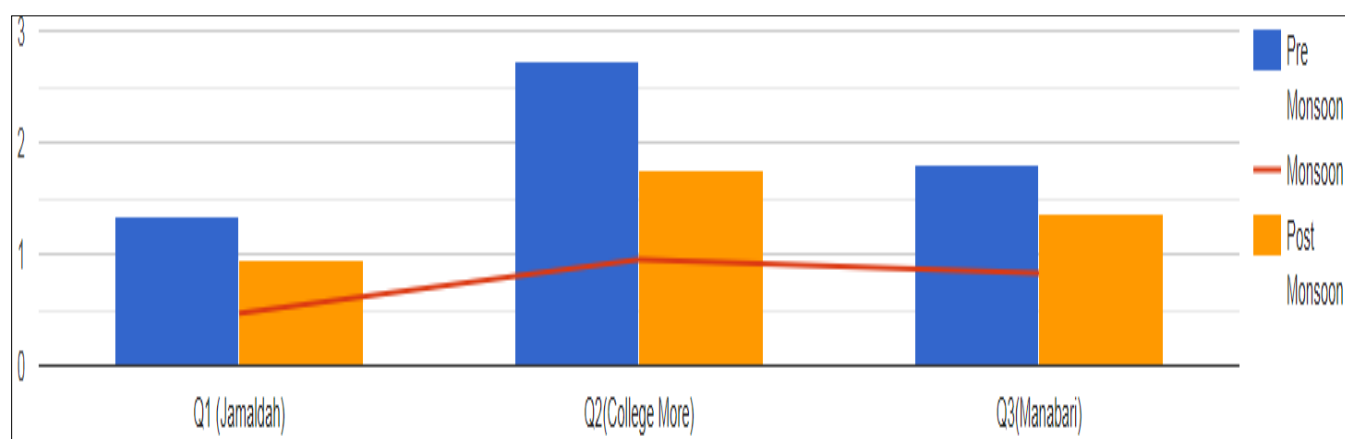Fig 4 Maximum and Minimum Ca^{2+} (mg/l) in 2007 and 2008 in river Damodar [23]

Fig 6 Mean BOD (ppm) value in Q1 (Jamaldah), Q2 (College More), QIII (Manabari) in Sutunga river [22]

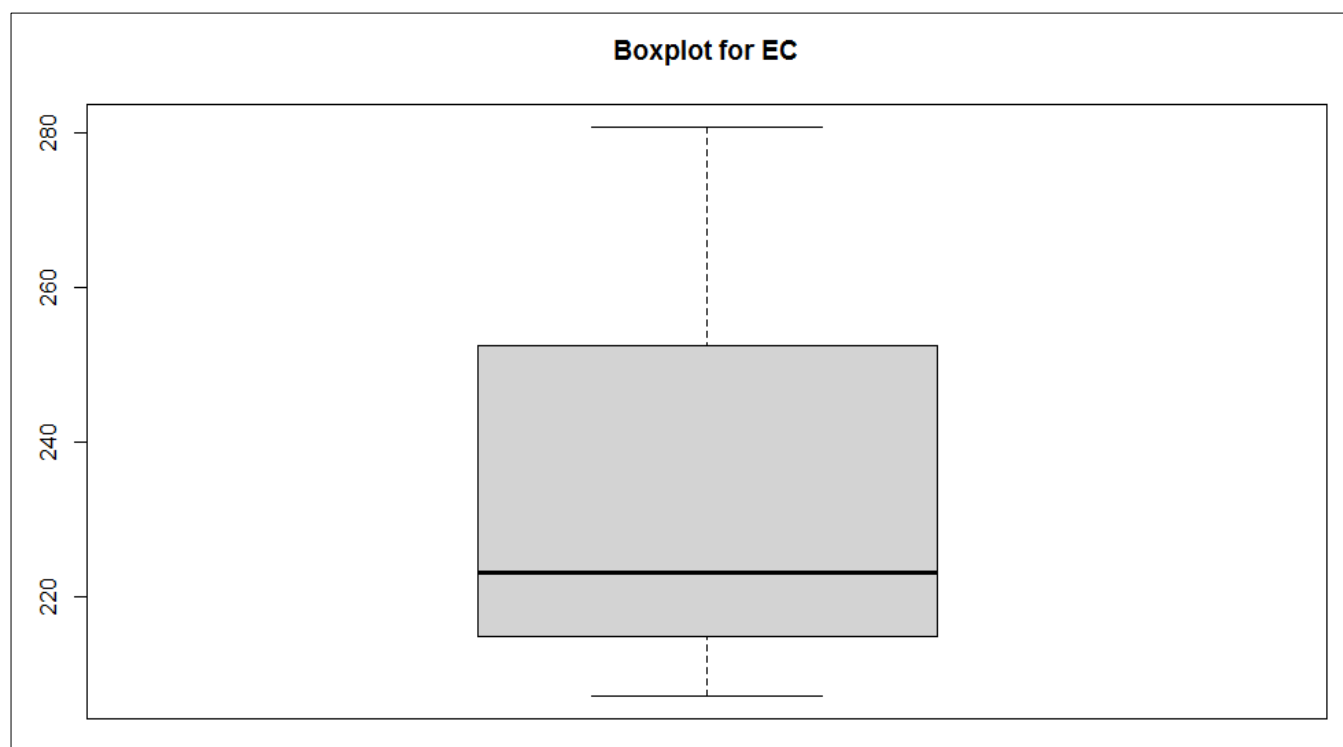![CARAS]

Boxplot for EC

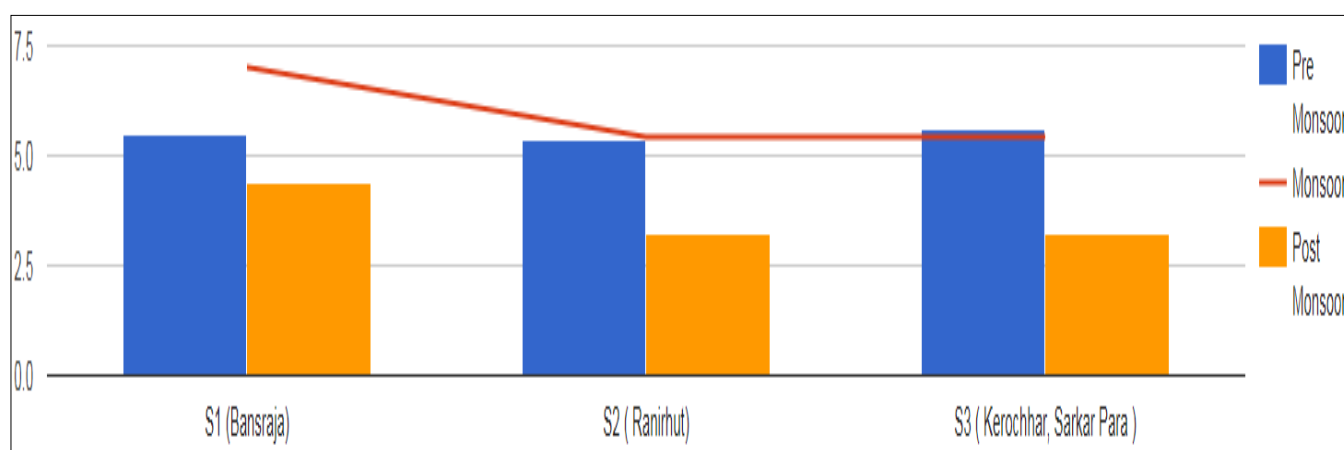
Fig 5 Boxplot for EC in Ajay River [24]

Fig 7 Mean dissolved oxygen (ppm) value in S1 (Bansdraja), S2 (Ranirhut), S3 (Kerochhar, Sarkar Para) in Raidak river [25]
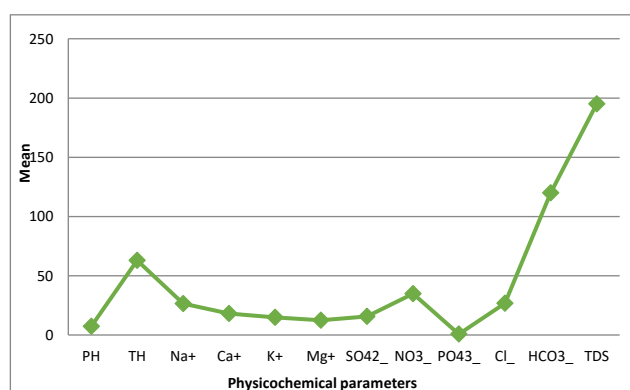

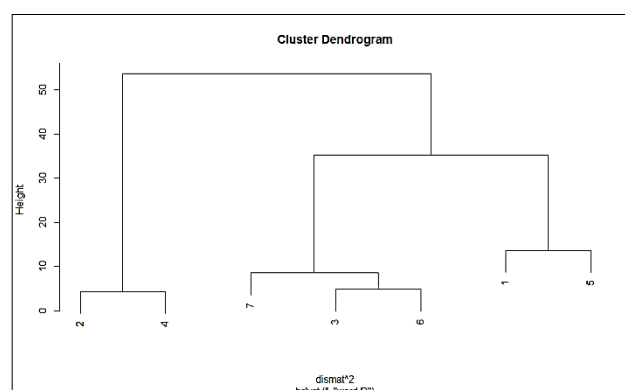Fig 8 Mean physicochemical parameters in Mayurakshi river [20]

Fig 9 Cluster analysis of physicochemical parameters of seven sites in Ajay River [24]

Recommendation

1) Must develop technology to keep away drain from river water.
2) Effluents removal machinery should be installed.
3) We must ensure that dead bodies should not be entered into river.

4) We should use environmentally friendly products.
5) Proper recycling of industrial wastes must be ensured.
6) In the river bathing of animals should be prohibited.
7) Only use detergents that are phosphate - free as phosphate creates an environmental hazard in the river.

Res. Jr. of Agril. Sci. (Jan-Feb) **13**(1): 231–234

234

CONCLUSION

Water quality showed some rivers were low to moderate pollution in West Bengal. In this review we assemblage different parameters (BOD, EC, Salinity, TDS, etc.) of some important river's water. Alteration of water quality was observed in rivers. Some rivers' water quality was changed season by season. In the Sutunga river mean dissolved oxygen was lower in post-monsoon. Water quality variation of Damodar River in the Industrial area was shown in research. Pollution harms aquatic plants and animals. High level of river pollution destroys the food chain. Special attention must be needed where water is higher than the permissible limit. To save the environmental threat regular monitoring and awareness are highly needed.

Conflict of interest

The authors do not have any conflict of interest.

LITERATURE CITED

1. Moore GK. 1978. Satellite surveillance of physical water-quality characteristics. *Proceedings of 12th International Symposium on Remote Sensing of Environment* 1: 445-462.
2. Lillesand TM, Kiefer RW. 1979. *Remote Sensing and Image Interpretation*. Wiley, New York
3. Marilia VJ, Günther F, Paulo RP, de Araujo. 2010. A saprobic index for biological assessment of river water quality in Brazil (Minas Gerais and Rio de Janeiro states). *Environ. Monit. Assess* 163: 545-554.
4. Winter TC, Mallory SE, Allen TR, Rosenberry DO. 2000. The use of principal component analysis for interpreting ground water hydrographs. *Ground Water* 38: 234-246
5. Khalil B, Ouarda TBMJ, St-Hilaire A, Chebana F. 2010. A statistical approach for the rationalization of water quality indicators in surface water quality monitoring networks. *Journal of Hydrology* 386: 173-185.
6. Khadka RB, Khanal AB. 2008. Environmental management plan (EMP) for Melamchi water supply project, Nepal. *Environ. Monitor Assess* 146(13): 225234
7. Sponza D, Karaoglue N. 2002. *Environ. Int.* 27(7): 541-553.
8. Mohammad A, Pathak JK. 2010. Rapid assessment of water quality index of Ramganga river, Western Utter Pradesh (India) using a computer programme. *Nature and Science* 8(11): 1-8.
9. Sabata BC, Nayar MP. 1995. *River Pollution in India*. APH Publication Corporation, New Delhi.
10. Sakai, Hiromitsu, Kojima Y, Saito K. 1986. Distribution of heavy metals in water and sieved sediments in the Toyohira River. *Water Research* 20(5): 559-567.
11. Bertin C, Bourg ACM. 1995. Trends in the heavy metal content (Cd, Pb, Zn) of river sediments in the drainage basin of smelting activities. *Water Research* 29(7): 1729-1736.
12. Gangwar S. 2013. Water quality monitoring in India: a review. *Int. Jr. Inf. Comp. Technology* 3: 851-856.
13. Anand VS, Pandey J. 2014. Heavy metals in the midstream of the Ganges river : Spatio- temporal trends seasonally dry tropical region (India). *Water International*. pp 1-13.
14. Singh AK, Tiwari RK, Kanaujia DR, Mishra P. 2009. Physicochemical parameters of Ganga River water at Varanashi. *Jr. Ecobiology* 25(1): 45-56.
15. Hujare MS. 2008. Seasonal variation of physico-chemical parameters in the perennial tank of Talsande, Maharashtra. *Ecotoxicol. Environ. Monitoring* 18(3): 233-242.
16. Durrani IA. 1993. Oxidative mineralization of plankton with its impact on eutrophication of Bhopal. *Ph. D. Thesis*, Barkatullah University, Bhopal.
17. Birge WJ, Black JA. 1980. *Aquatic Toxicology of Nickel*. Nickel in the Environment. John Wiley and Sons, New York. pp 349-366.
18. Basu S, Banerjee T, Manna P, Bhattacharyya B, Guha B. 2013. Influence of physicochemical parameters on the abundance of Coliform bacteria in an Industrial Site of the Hooghly River, India. *Proceedings of the Zoological Society* 66(1): 20-26.
19. Sinha K, Das P. 2015. Assessment of water quality index using cluster analysis and artificial neural network modeling: a case study of the Hooghly River basin, West Bengal, India. *Desalination and Water Treatment* 54(1): 28-36.
20. Ghosh S, Chaudhury S, Manoj K. 2017. An appraisal of the Mayurakshi River system water quality–the Agrarian Basin. *Int. Jr. Agric. Environ. Sciences* 4(4): 53-59.
21. Mondal I, Bandyopadhyay J, Paul AK. 2016. Water quality modeling for seasonal fluctuation of Ichamati river, West Bengal, India. *Modeling Earth Systems and Environment* 2(3): 1-12.
22. Saha A. 2017. A study on physico-chemical water quality and bio-diversity loss of a river in a small town of West Bengal. *International Journal of Pharmaceutics and Drug Analysis*. pp 212-218.
23. Banerjee US, Gupta S. 2010. Seasonal assessment of irrigation water suitability of river Damodar in West Bengal, India. *Journal of Crop and Weed* 6(1): 6-12.
24. Kumar B, Singh UK, Padhy PK. 2014. Water quality assessment of Ajay River with reference to suitability for agricultural purposes.
25. Saha A, De CG, Das D. 2019. The study of correlation between physico-chemical parameters and ichthyofaunal diversity at raidak river flowing through the Coochbehar district of west Bengal, India. *International Journal of Basic and Applied Research*. ISSN 2249-3352 (P) 2278-0505 (E)
26. Ghosh AR, Banerjee R. 2012. Qualitative evaluation of the Damodar river water flowing over the coal mines and industrial area. *Int. Jr. Sci. Res. Publication* 2(10): 1-6.