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Seasonal variation in physico-chemical parameters of the water of River Karamnasa at Buxar, Bihar

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Abstract- The quality of river body is determined by its physico-chemical parameters. The physico-chemical parameters refer as Temperature, Transparency, pH, DO, Free CO₂, Total Alkalinity, Nitrate, Phosphate, BOD and COD. These parameters provide all necessary informations regarding the suitability of water for its use as well as for improving its quality. The present investigation is done to find out the impact of season on physico-chemical parameters of the water of River Karamnasa at Buxar, Bihar. For this purpose, various physico-chemical parameters were studied during the whole period of investigation from March 2019-February 2020 and noticed the changes on the parameters due to season. The result of present finding showed that the physico-chemical parameters of the water of River Karamnasa Varied seasonally. Temperature and Free CO₂ were maximum in summer while these were minimum in winter. pH, Transparency and total alkalinity were recorded maximum in summer while minimum in monsoon season. The DO was maximum in winter while it was minimum in monsoon. Nitrate, Phosphate, BOD and COD were found maximum in monsoon while these were minimum in winter.

Key words: Physico-chemical parameters, Season change, Karamnasa River, Buxar, Bihar

INTRODUCTION

Riverine system is one of the important freshwater resources on the earth. River bodies are the most abundant and familiar liquid that closely related to social, economical and political development of the country. Because, river serves as a source of water supply to meet domestic, industrial, agricultural, fisheries and power generation needs. But, increasing population, rapid growth of industrialization and urbanization deteriorate the quality of river body. The quality of a river body depends upon

the different physico-chemical parameters. Physico-chemical parameters also provide all necessary information regarding the suitability of water for its use as well as for improving its quality. It is essential to know the physico-chemical parameters of river body for assessment of its quality. The physico-chemical parameters refer as temperature, Transparency, pH, DO, Free CO₂, Total Alkalinity, Nitrate, Phosphate, BOD and COD. These parameters are directly influenced by season.

Various works contributed towards the better understanding of seasonal variation in physico-chemical parameters of aquatic body. Some of them are cited here such as Odum (1971)¹, Das *et al.*(1992)², Khaiwal *et*

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al.(2003)³, Srivastava *et al.* (2003)⁴, Singh *et al.* (2004)⁵, Deshmukh *et al.*(2006)⁶,Chaurasia *et al.* (2007)⁷, Bhandari *et al.* (2008)⁸, Prasad *et al.* (2008)⁹, Ahmed *et al.* (2010)¹⁰, Bhatt *et al.*(2010)¹¹, Pathak *et al.*(2011)¹², Sahni *et al.* (2012)¹³, Singh P. (2014)¹⁴, Singh *et al.* (2016)¹⁵, Balkrishna *et al.* (2017)¹⁶, Ramanathan and Asmath (2018)¹⁷.

From a review of literature cited above, it appears that a lot of works on seasonal variation in physico-chemical parameters of water body has already been done. But no work was done to evaluate the seasonal impact on physico-chemical parameters of the water of river Karamnasa at Buxar, Bihar. Thus the present project deals with the seasonal variation in physico-chemical parameters of the water of river Karamnasa.

MATERIAL & METHOD

River Karamnasa is one of the largest and Perennial Rivers of Bihar. It originates at a height of 350 meters on the Northern face of Kaimur range near Sarodag in Kaimur district of Bihar. It flows in North-western direction through the plain of Mirzapur, then forms the boundary between U.P. and Bihar and finally joins with River Ganga at Chausa (Buxar). River Karamnasa is a tributary of River Ganga and hence shows various similarities in biological features with River Ganga. The total drainage area of river Karamnasa is approx. 4251 sq mile. Along its course, the river carries the discharge of many canals, household and agricultural effluents containing organic and inorganic wastes from adjoining areas.

Area of study: To analyse the different parameters, three sampling sites were selected that stretches to a distance of 5 km covering the entire length of river passing through district Buxar upto the confluence with River Ganga. Site I was situated near the village Banarpur, were river carries domestic sewage, agricultural and ricemill effluents. Site II was placed near the village Narbatpur. At this site, the river carries household, washing, bathing, cattle wallowing and agricultural effluents. This site was 2 km downstream from site I. Site III was about 1 km downstream from site II, near the confluence of River Karamnasa and River Ganga. All the above sites showed a varied ecological conditions and hence helpful to analyse the seasonal variation in physico-chemical parameters.

Collection and preservation: The samples were collected in different season i.e. summer (March to June), monsoon (July to October) and winter (November to February) by using plastic canes of size 1 litre. The

collected samples were transferred to laboratory with taking precautions. The water samples were preserved at 4°C temperature and different physico-chemical parameters were mostly tested within one day of collection. The parameters were analysed by standard method of APHA (2005)¹⁸. Temperature was calculated by simple thermometer. pH metre was used to find the pH of water. Transparency was noticed by using Secchi-disc method. Wrinkler Idometric method was used to find out DO content. Free CO₂, total alkalinity, nitrate, phosphate, BOD and COD were calculated by Titration method.

RESULT & DISCUSSION

During the whole period of investigation, the result of findings of different physico-chemical parameters of river Karamnasa are shown in table (1). Temperature of river body is directly influenced by solar radiation (Yadav *et al.*, 2008)¹⁹ and photoperiod (Odum,1971)¹. Both solar radiation and photoperiod were higher in summer than in winter. In present investigation, the temperature was ranged from 21.0°C to 32.6°C. The minimum temperature was 21.0°C at site I in winter season while maximum temperature was 32.6°C at site III in summer. The result was supported by the findings of Khanna *et al.* (2016)²⁰.

Transparency refers the suspended dirt and other particles in water. It restricts the penetration of light. In the present investigation, maximum transparency was 79.0 at site I in summer season while minimum transparency was 15.9 at site II during monsoon. Transparency showed an inverse relationship with light penetration. In present study, light penetration was high in monsoon while it was low during summer. The similar result was found by Srivastava *et al.*(2003)⁴ and Ahmed *et al.*(2010)¹⁰.

pH plays an important role in biological activities. Such activities occur only within a narrow range of pH. The pH of river Karamnasa was maximum as 8.2 at site I in summer season while it was minimum as 7.1 at site II in monsoon. Hence, the pH of present finding was ranged from 7.1 to 8.2. the observed result was supported by the finding of Das *et al.*(1992)².

Dissolved Oxygen (DO) of water body directly influenced the survival and distribution of fauna and flora in it. DO of present finding was ranged from 6.6 mg/l to 10.1 mg/l. The maximum DO was 10.1 mg/l at site I in winter and minimum DO was 6.6 mg/l in monsoon at site III. Similar finding was observed by Sahni *et al.* (2012)¹³ and Singh (2014)¹⁴.

Free CO₂ of a river body was inversely related with concentration of DO (Odum,1971)¹. In present study maximum Free CO₂ was 10.4 mg/l at site II in summer while it was minimum at as 1.0 mg/l at site I in winter season. The maximum level of Free CO₂ was due to increase population density of aerobic organisms. Bhandari *et al.* (2008)⁸ also found similar result.

Total alkalinity is one of the important parameter which decides the quality of water for the use of irrigation and drinking. It neutralizes acid and hence it assess the presence of pH. In present finding, the total alkalinity was maximum as 195.8 mg/l at site II in summer and it was minimum as 136.5 mg/l at site III in monsoon season. the findings was also supported by Chaurasia *et al.* (2007)⁷.

Nitrate concentration in river body is associated with discharge of N₂ wastes as well as sewage water. The nitrate content of river Karamnasa was maximum as 0.6 mg/l at site II in monsoon. The minimum value of nitrate was 0.1

mg/l at site I in winter season. The similar result was also found by Deshmukh *et al.*(2006)⁶.

Phosphate value of present finding was maximum in monsoon at site II as 4.7 mg/l and value was minimum in winter season at site I as 0.4 mg/l. the above finding was supported by Venkatesharaju *et al.* (2010)²¹.

BOD reduces the DO concentration in river body. Excess BOD load damage the quality of river body. Highest BOD of river Karamnasa was recorded 6.2 mg/l at site II in monsoon while minimum BOD was 3.2 mg/l at site II in winter. High value of BOD indicates higher O₂ consumption and heavy pollution load. The findings was also supported by finding of Bhatt *et al.*(2010)¹¹ and Deshmukh *et al.*(2006)⁶.

COD value was maximum as 10.9 mg/l at site II in monsoon while it was minimum as 7.1 mg/l at site I in winter season. Singh *et al.* (2014)¹⁴ also found the same result.

Table 1- Seasonal variation in different physico-chemical parameters from March 2019-February 2020

Parameters	Season	Site I	Site II	Site III	Mean
Temperature(°C)	Summer	30.8	31.5	32.6	31.6
	Monsoon	29.6	28.8	27.9	28.7
	Winter	21.0	21.2	21.1	21.1
Transparency(NTU)	Summer	79.0	77.5	75.7	77.4
	Monsoon	16.4	15.9	18.3	16.9
	Winter	70.1	72.0	70.6	70.9
pH	Summer	8.2	7.8	8.0	8.0
	Monsoon	7.6	7.1	7.2	7.3
	Winter	7.3	7.7	7.9	7.6
Dissolved Oxygen (mg/l)	Summer	8.3	7.8	7.1	7.7
	Monsoon	6.7	7.6	6.6	7.0
	Winter	10.1	8.5	8.3	8.9
Free CO ₂ (mg/l)	Summer	5.0	10.4	6.9	7.4
	Monsoon	1.3	8.7	4.9	4.9
	Winter	1.0	4.7	2.5	2.7
Total Alkalinity (mg/l)	Summer	157.3	195.8	160.3	171.1
	Monsoon	137.8	155.5	136.5	143.3
	Winter	136.8	156.6	142.6	145.3
Nitrate(mg/l)	Summer	0.3	0.3	0.4	0.3
	Monsoon	0.4	0.6	0.2	0.4
	Winter	0.1	0.3	0.2	0.2
Phosphate(mg/l)	Summer	0.8	2.3	0.9	1.3
	Monsoon	0.8	4.7	0.8	2.1
	Winter	0.4	3.3	0.6	0.7
BOD(mg/l)	Summer	4.1	4.4	5.2	4.6
	Monsoon	5.8	6.2	6.0	6.1
	Winter	3.5	3.2	3.8	3.5
COD(mg/l)	Summer	9.3	9.4	9.5	9.4
	Monsoon	10.3	10.9	10.6	10.6
	Winter	7.1	7.2	7.4	7.2

CONCLUSION

In the present investigation, it was concluded that seasonal changes are the major factor in variation of the physico-chemical parameters of the water of river Karamnasa. During the whole study period, it was also found that different parameters of this river were within the permissible limits and with the agreement with Prasad *et al.* (2008)⁹, Singh *et al.* (2016)¹⁵ and Ramanathan S. (2018)¹⁷. The water quality of river Karamnasa is also suitable for human use as well as appropriate for fish culture.

REFERENCES

1. **Odum E.P. 1971.** Fundamentals of ecology. 3rd edition W.B., Philadelphia, pp-554.
2. **Das H.B., Kalita H. & Kannur S.B. 1992.** Physico-chemical characteristics of Brahmaputra water Tezpur. *Pollution Research*. **11(3)**:169-172.
3. **Khairwal, Ravindra & Anubha Kaushik. 2003.** Seasonal variations in physico-chemical characteristics of river Yamuna in Haryana. *Journal of Environmental Monitoring*. **(5)**:419-426.
4. **Srivastava, N., Agrawal, M., & Tyagi, A. 2003.** A study of physico-chemical characteristics of water bodies around Jaipur. *Journal of Environmental Monitoring*. **24**:177-180.
5. **Singh M. & Gupta K.C. 2004.** Physico-chemical studies of river Yamuna of Mathura. *Eco. Env. and Conv.* **10(2)**:193-196.
6. **Deshmukh, J. U., & Ambore, N. E. 2006.** Seasonal variation in physico-chemical aspects of pollution in Godavari River at Nanded, Maharashtra. India. *J.Aqua.Biol.* **21(2)**: 93-96.
7. **Chaurasia, M., & Pandey, G. C. 2007.** Study of physico-chemical characteristics of some water ponds of Ayodhya- Faizabad. *JEP.* **27(1)**:1019-1023.
8. **Bhandari N.S. & Nayal K. 2008.** Correlative study on physico-chemical parameters and quality assessment of Kosi river water, Uttarakand. *Electronic Jour. of Chem.* **5(2)**:342-348.
9. **Prasad, N. R., & Patil, J. M. 2008.** A study of physico-chemical parameters of Krishna river water particularly in western Maharashtra. *Rasayan J. Chem.* **1(4)**:943-958.
10. **Ahmed. 2010.** Water quality assessment of river Gomati at Lucknow (U.P.), India. *Aquaculture*. **11(1)**:39-46.
11. **Bhatt M. & Yunus M. 2010.** Seasonal variation of physico-chemical characteristics in several ponds of Lucknow city affected by Urban drainage. *Advance Environmental Biology*. **6(10)**: 2654-2663.
12. **Pathak P., Sinha U.S. & Srivastava M.L. 2011.** Physico-chemical quality of river Thora at Buxar. *Modern J. Life Science*. **10(1-2)**:55-58.
13. **Sahni K. & Yadav S. 2012.** Seasonal variations in physico-chemical characteristics of Bharawas pond, Haryana. *Asian J. Exp. Sci.* **26(1)**:61-61.
14. **Singh P. 2014.** Studies on seasonal variations in physico-chemical parameters of the river Gomati (U.P.), India. *International Journal of Advanced Research*. **2(2)**:82-86.
15. **Singh, P. K., Shrivastava, P., & Borana, K. 2016.** Seasonal variations in physico-chemical parameters of river Narmada (M.P.), India. *IJSR*. **5(1)**:367-371.
16. **Balakrishnan, S., Chelladurai, G., Mohanraj, J. and J. Poongodi. 2017.** Seasonal variations in physico-chemical characteristics of Tuticorin coastal waters southeast coast of India. *Applied Water Science*. **7(4)**:1881-1886.
17. **Ramanathan S. & Asmath A. 2018.** Seasonal variation in physico-chemical parameters of Puthukulam pond, Tamil Nadu. *Res. J. of Life Science*. **(10)**:181-187.
18. **APHA. 2005.** Standard method for examination of water and waste water. 21st Edn,
19. **Yadav S.K., Sharma S.P. and Sahu B. 2008.** Physico-chemical characteristic and phytoplankton of Betwa river, Vidisa district (M.P.), *Indian. J. Environ & Ecoplan.* **15(3)**:557-580.
20. **Khanna, D. R., Bhutiani, R., Matta, G., Singh, V., & Bhadauriya, G. 2011.** Physico-chemical property of river Ganga at foothills of Garhwal Himalayas. *Environment Conservation Journal*. **12(3)**:163-168.
21. **Venkatesharaju, K., Somashekar, R. K., & Prakash, K. L. 2010.** Study of seasonal variation in surface water quality of Cauvery river stretch in Karnataka. *Journal of Ecology and Natural Environment*. **2(1)**:001-009.
