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IMPACT OF ANTHROPOGENIC ACTIVITIES ON PHYSICOCHEMICAL PROPERTIES OF WATER AND SEDIMENT SOIL OF A PERENNIAL POND OF GODDA DISTRICT (SANTAL PARGANA), JHARKHAND

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ABSTRACT

During ethnobotanical study of Sikar district (Rajasthan), observations were made on the timbers used by Limnological investigation of fresh water bodies determines potential value of water for biological production. Perennial ponds are productive source of aquatic biota. Nowadays, anthropogenic activities like bathing, washing of clothes, utensils, immersion of idols and disposal of domestic wastes, cattle dumping, etc are adversely affecting the pond ecosystem. Moreover lack of awareness among users is growing day by day which affects health of the water bodies. Fresh water bodies are always at risk so its proper management and regular quality assessment become essential to maintain the ecological balance. With this background impacts of human activities on physicochemical and biological properties of the pond water and its sediment were assessed in Rajkachari pond situated in the northern side of Godda district known as in Santal Pargana of Jharkhand. The plan of work includes on spot survey and laboratory analysis of water and sediment samples. Physicochemical properties of pond water (water temperature, transparency Dissolved oxygen, Free Carbon dioxide, Bicarbonate Alkalinity, Total hardness, Total Dissolved Solid, Phosphate, Nitrate) and sediment (soil organic Carbon, nitrogen, phosphorus, potassium were determined by following standard methods. Water sampling and analysis were carried out periodically on a monthly basis for twelve months from January 2018 to December 2018. The investigation revealed remarkable variations in physico-chemical variables like free Carbon dioxide, Total dissolved solid, Chloride, Phosphate, Nitrate of water and sediment soil (organic carbon, nitrogen, phosphorus, potassium) in the pond, probably due to human induced allochthonous input of organic matter mainly due to idol immersion, washing of clothes, and regular influx of domestic waste, leading towards eutrophication process.

Key words: Physicochemical factors, Pond water contamination, Anthropogenic activities

INTRODUCTION

Most of the ponds are becoming polluted due to various human activities such as bathing, washing of clothes, utensils, immersion of idols and disposal of domestic wastes. All these interferences are ultimately causing undesirable change in physico-chemical and biological properties of water as well as sediment soil which finally affect the productivity of pond. Fish productivity mostly depends upon the water quality and soil properties of fresh water bodies. Water quality is a reflection of anthropogenic activities including the use and measures. The observations on physicochemical properties of inland water bodies made by Kamath et al. (2006), Dhirendra et al.(2009), Mahananda et al.(2010), Debnath et al. (2011), Nkwocha et al. (2011), Yadav & Kumar (2011), Ajit et al. (2012), Kumar et al. (2014), Abdul et al. (2015), Borkar (2015), Chakravarty et al. (2016) have been of special relevance to this investigation.

STUDY AREA:

The pond under investigation is situated in the district town area of Godda under Santhal Pargana division of Jharkhand State, India, popularly Known as Rajkachari pond. It is perennial in nature. The area of the pond is about 1.6 ha and rectangular in shape. The average depth is 4.0m. Rajkachari pond is a good source of fish culture and fulfills fish demand of Godda district. It is surrounded by human habitation and affected by various anthropogenic activities mainly by dumping of domestic and municipal sewage, cattle dumping, washing of clothes, utensils, idol immersions etc. The monsoon water runoff also enters pond through inlet.

MATERIALS AND METHODS

Physico-chemical properties of water and sediment soil condition in the pond were studied during twelve month period (January 2018 to December 2018). Water samples were collected in monthly interval from surface of the pond at 9am to 10am. Water and Soil samples were analyzed like temperature, transparency, pH, dissolved oxygen, free carbon dioxide, were determined on the spot, according to the method prescribed by Trivedy and Goel (1986). Soil samples were collected from four sampling spot in the pond bottom and analyzed for its texture, P^H, Electrical Conductivity, Organic carbon, available phosphorus, potassium and nitrate were investigated following standard methods (Trivedy and Goel 1986).

RESULTS AND DISCUSSION

The results obtained are presented in Table (1) and illustrated in Fig 1-5. Minimum and maximum temperature of water was 18^0C (December) and 30^0C (July) respectively with mean temperature of 23.91^0C. Minimum value of transparency was 22cm (November) while its maximum value 38cm (May) with mean value of 29.91cm. During this period floating vegetation partially infested water's surface that hinder light penetration. The maximum value of pH was 8.4(September) and minimum was 7.1(May). Pond water was thus alkaline within a safe range for aquatic biota. Minimum and maximum values of dissolved oxygen were 5.2mg/L (September) and 7.2 mg/L (May) respectively. Dissolved Oxygen content explains general health of a water body and is a quality variable that reflects the capacity of a system to support a balanced aquatic habitat. Dissolved oxygen range (5.2-7.2 mg/L) was above the critical level for survival of aquatic life including fish. This demonstrates that pond has high assimilative capacity and is proper for survival of aquatic biota. The minimum value of free carbon dioxide was 3.2mg/L (January) and the maximum value (4.4mg/L) was found in August. Minimum and maximum value of total alkalinity were 154mg/L (March) and 210mg/L (December) respectively. Chakravarty et al. (2016) reported alkalinity between 120 to 500 mg/L in different ponds of east Godavari district. Minimum value of total hardness was found in January (225mg/L) while maximum value was found in August (310mg/L). Total Hardness varied from 225-310mg/L is an important factor for domestic as well as industrial purposes. ICMR has set highest desirable level for total hardness as 300ppm. In general hardness has got no adverse effect on human health. Water with hardness above 200mg/L may cause scale deposition in the water distribution system and more soap consumption. Hardness value less than 50mg/L can be considered as soft water. The minimum value of Chloride was found in February (39 mg/L) and the maximum value in September (71mg/L). Chloride content of water was within desirable limit of 250mg/L. and suitable for fish culture. Minimum and maximum values of total dissolved solids were 265mg/L (December) and 340mg/L (August) respectively. The quantity of TDS is proportional to the degree of pollution may be due to addition of dissolved solids in the water runoff. The higher value of total dissolved solids indicates a considerable influx of sewage that may adversely affect macro benthic fauna and productivity of the pond. The minimum value (0.45mg/L) of phosphate was observed in winter (December) while maximum value (0.64mg/L) in the rainy season (July). The phosphate concentration above 0.5mg/L indicates a process towards eutrophication. The higher values may be due to presence of detergents in sewage waste discharged in the pond. The minimum value (17.4mg/L) of silicate was recorded in January and the maximum value (22.1mg/L) was recorded in September. Nitrate values ranged between 0.46 to 0.63 mg/L with the mean value 0.525mg/L indicates high pollution load. Intrusion of sewage into the natural water increases level of nitrate. It was observed that concentrations of phosphate and nitrate were considerably higher. The pond received nutrients from sewage as well as from anthropogenic activities like bathing and washing playing a significant role in high concentration of nutrient rich in pond that may manifest phenomenon like eutrophication.

Sediment plays significant role in pond ecosystem. pH of soil is one of the most important parameter affecting quality and quantity of nutrients and microbial activities. Sediment soil was slightly alkaline (7.27-7.41) having normal electrical

Table 1. Monthly variations of physico-chemical parameters of pond water

Month (2018)	Water Temp (0^0c)	Traspa rency (cm)	pH	TDS (mg/L)	$D0_2$ (mg/L)	FCo_2 (mg/L)	Alkal-- inity (mg/L)	Total hardness (mg/L)	Chlo- ride (mg/L)	Phosphate (mg/L)	Nitra-ate (mg/L)	Silicate (mg/L)
Jan	19	29	7.6	270	6.6	3.2	178	225	42	0.49	0.51	17.4
Feb	20	31	7.4	281	6.7	3.5	167	238	44	0.56	0.49	18.2
Mar	22	34	7.8	285	6.4	3.4	154	244	47	0.61	0.46	19.5
Apr	24	36	7.5	292	6.9	3.8	162	259	49	0.59	0.53	19.1
May	26	38	7.1	303	7.2	4.1	171	268	54	0.62	0.47	19.9
Jun	28	37	6.9	315	6.1	4.3	177	281	58	0.61	0.58	20.2
July	30	32	7.3	334	6.4	3.9	189	290	66	0.64	0.62	20.7
Aug	27	28	7.5	340	5.9	4.4	179	320	63	0.65	0.63	21.4
Sep	26	25	8.4	310	5.2	4.2	185	239	61	0.58	0.61	22.1
Oct	25	24	7.9	282	5.6	4.1	192	244	59	0.53	0.59	19.5
Nov	22	22	7.5	278	6.2	3.8	20	274	56	0.51	0.57	19.1
Dec	18	23	7.2	265	6.1	3.7	210	269	48	0.45	0.52	18.6
RANGE VALUE	18^0- 30^0	22- 38	7.1- 8.4	265- 340	5.2- 7.2	3.2- 4.4	154- 210	225- 310	42- 66	0.45- 0.65	0.46- 0.63	17.4- 22.1

Except pH, temperature (Temp.), Transparency (Trans.); all values are in mg/L

Fig.1. Monthly variations of Water temperature (0^0c) and Transparency (cm)

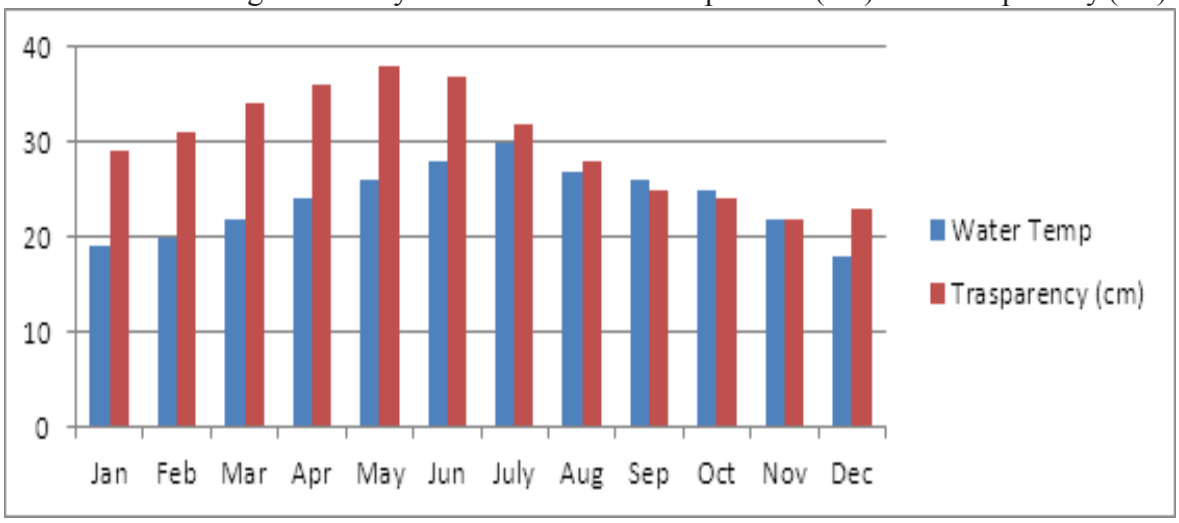

Fig. 2. Monthly variation of pH, Dissolved Oxygen and Free Carbon dioxide

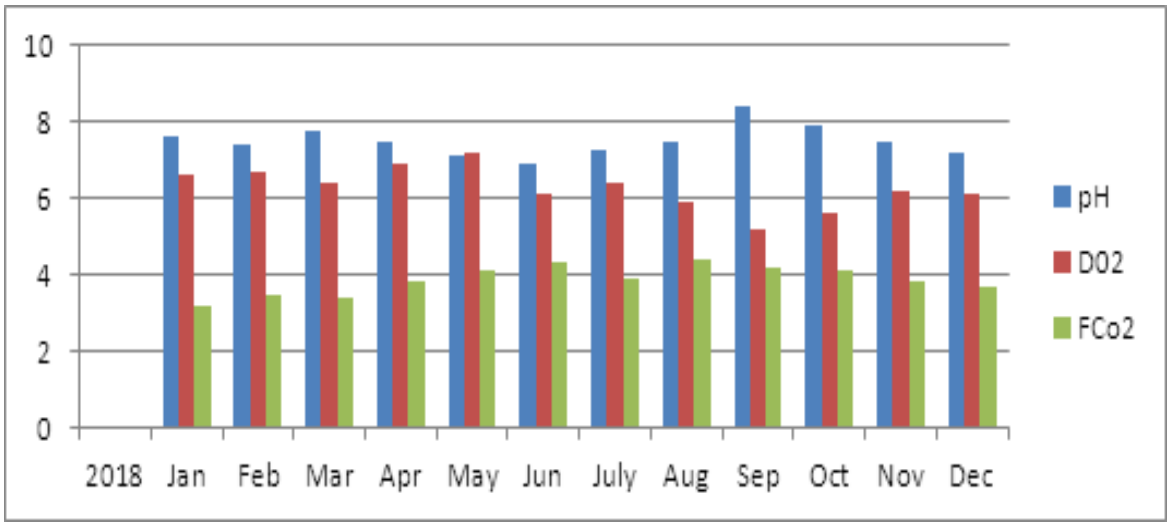

Fig. 3.Monthly variations of Alkalinity, Total hardness, Total dissolved solids

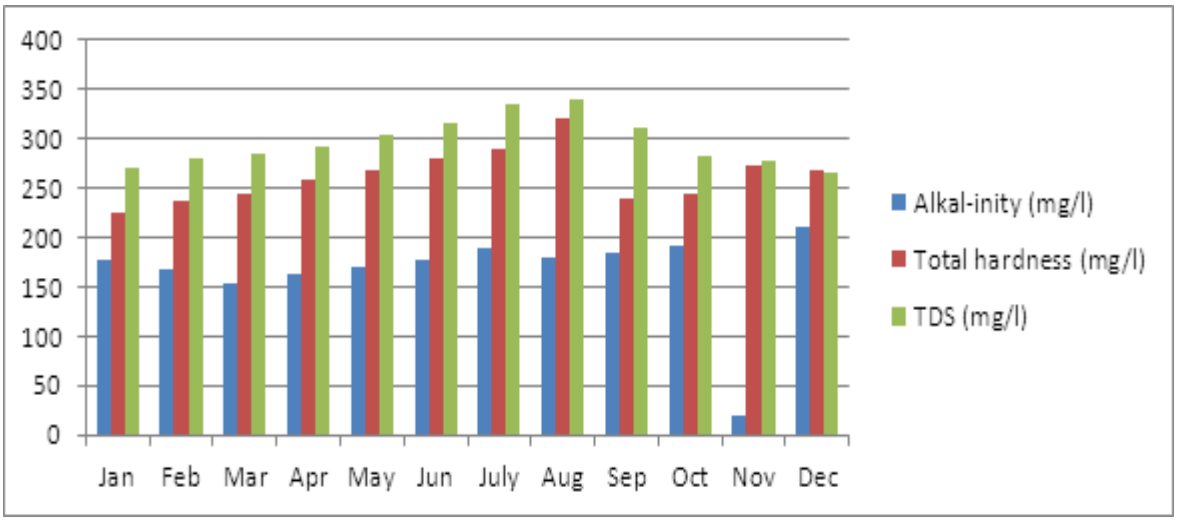

Fig. 4. Monthly variations of Chloride and Silicate (mg/L)

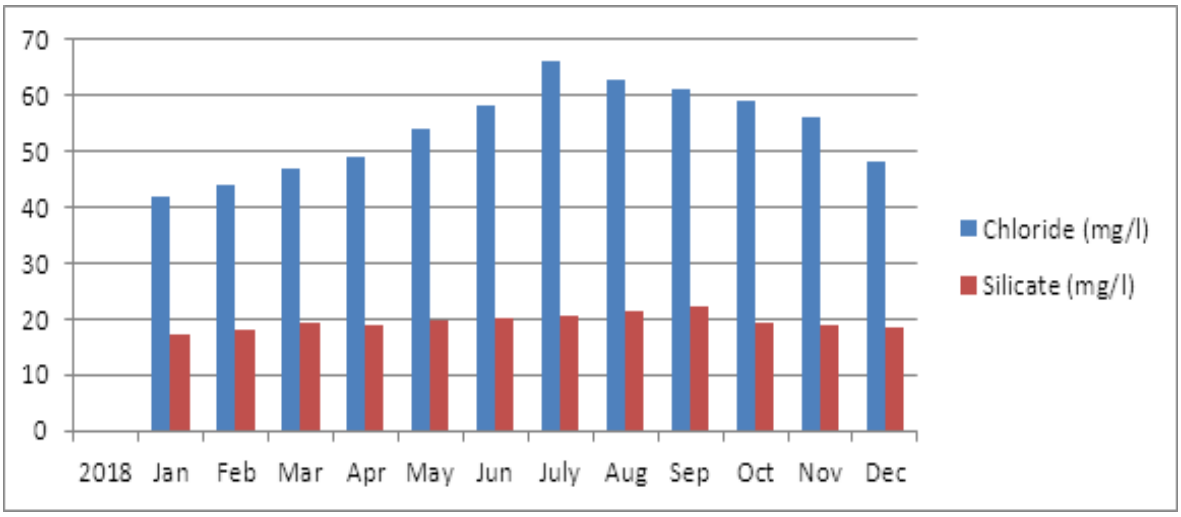

Fig.5. Monthly variation of Phosphate and Nitrate (mg/L)

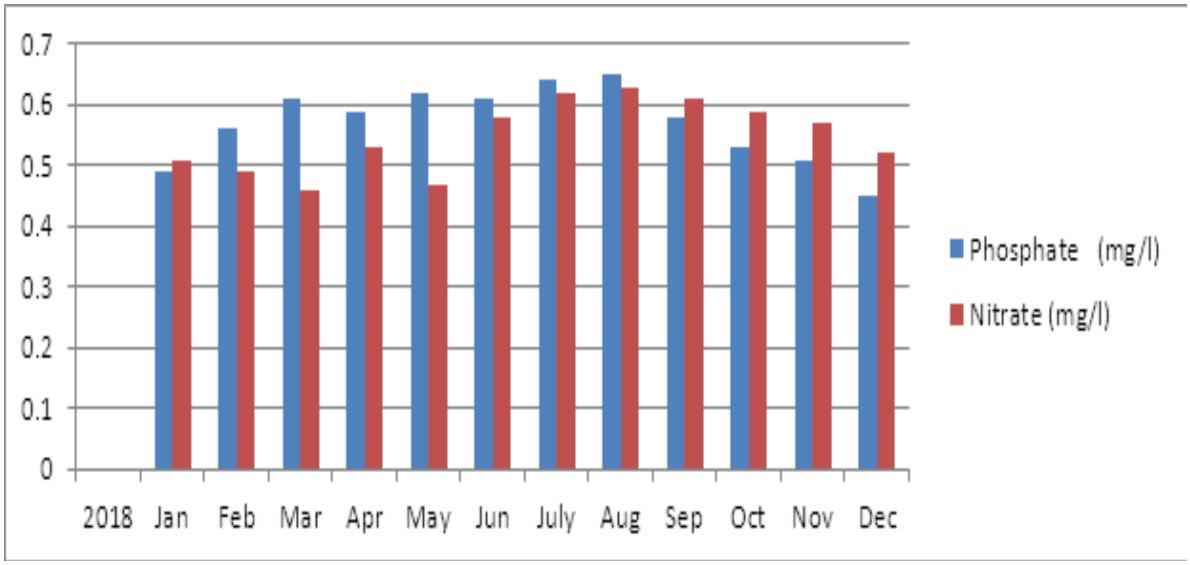

Table 2. Physico-chemical characteristics of the pond sediment

S.No.	PARAMETER	UNIT	RESULT
1.	pH	ppm	7.27-7.41
2.	Electrical conductivity(EC)	Dsm/m	0.60-0.65
3.	Organic Carbon	%	1.65 - 1.78
4.	Nitrogen(N)	Kg/ha	530.10 – 560
5.	Phosphorus(P)	Kg/ha	194.8 – 200
6.	Potassium(K)	Kg/ha	491.10-500

conductivity (0.60-0.65) for vegetation uptake. During investigation organic carbon (1.65-1.78%), nitrogen, phosphorus and potassium were found higher (Tablen2). Organic carbon plays an important role by releasing nutrients and providing buffering to soil and stabilizing sediment soil structure. In fact these properties along with pH, Organic Carbon Nitrogen, Phosphorus and Potassium were considered a critical indicator for healthy ecosystem.

CONCLUSSION

The observations substantiated by physico-chemical properties of water as well as sediment confirm that the pond receives organic pollution of human activities. Water quality in the pond is slowly reaching to alarming stage and therefore proper planning is essential to conserve its fragile ecosystem.

RECOMMENDATIONS

Certain effective measures may be taken into consideration to minimize the organic load of the pond ecosystem to sustain its productive potentiality.

1. Discharge of town sewage should be restricted.
2. Human activities like cattle dumping, idol immersion, washing of clothes etc should be strictly discouraged.
3. Periodical renovation by removing silt will help to restore its perennial nature and productivity.
4. Plantation around pond will check soil erosion that usually occur during monsoon.

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REFERENCES

Abdul, M.M., A. Abdullah and S. Abdelaziz. 2015. Impact of treated wastewater on some physico-chemical parameter soil and its fungal content. International Journal of Environmental Science and Development 6(5):369-374.

Ajit, M.K., A. Padmaker and A. Savale. 2012. Determination of physico-chemical parameters of Deoli bhorus dam water. Advances in Applied Science Research 3(1):273-279.

Borkar, A.D. 2015. Studies on some physcico-chemical parameters of soil samples in Katol taluka, district Nagpur, Maharastra, India. Research Journal of Agriculture and Forestry Sciences 3(1):16-18.

Chakravarty, M.S., P.R.C Ganesh, D. Amarnath, D.S., Sudha D. Srinu and T. Babu. 2016. Spatial variation of water quality (Litopenaeus Vannamei) culture ponds at Narsapurapupeta, Kajuluru and Kaikavolu villages of East Godavari district, Andhra Pradesh. International Journal of Fisheries and Aquatic Studies. 4(4): 390-395.

Debnath, P. and A. Mukherjee 2011. Characterisation of physicochemical properties of water and soil in Lalbandh, a freshwater wetland in Birbhum district, West Bengal, India. Ecology Environment & Conservation 17(3):557-562.

Dhirendra, M.J., K. Alok and A. Namita. 2009. Studies on physicochemical parameter to assess water quality of river Ganga for drinking purpose in Haridwar district. Rasayan Journal of Chemistry 2(1):195-203.

Devidas Kamath, E.T. Puttaiah, B. R. Kiran and Vijaya Kumara. 2006. Status of water quality in Ayanur tank near Shimoga district Karnataka. Nature Environment and Pollution Technology 5 (2):257-260.

Kumar, M.S., R. Chaurasia and S. Khare. 2014. Physicochemical examination of lotic water of river Yamuna at Kalpi, District Jalaun, UP, India. Journal of Environment Research and Development 10 (3):529.

Mahananda,M., B.P. Mohanty and N.R. Behra. 2010. Physicochemical analysis of surface and ground water of Bargarh district, Orissa India. International Journal of Recent Research and Applied Studies 2 (3):284-295.

Nkwocha, E.E., E.C.P, Mbano and A.O Nnaji. 2011. Effect of solid waste dump on river water quality. A Paradigm in a Nigeran tropical Environment. International Journal of Science and Nature 2(3): 501-507.

Trivedy, R.K. and P.K. Goel 1986. Chemical and Biological methods for water pollution studies, Environmental Publication, Karad.

WHO. 1998. World Health Organisation Anon, Guidelines for Drinking Water quality. World Health Organization Geneva.

Yadav, S.S., and R. Kumar. 2011. Monitoring water quality of Koshi river in Rampur district, UP India. Advance in Applied Science Research 2(2):197-201.