STUDY OF PHYSICOCHEMICAL PARAMETERS IN REFERENCE TO ZOOPLANKTON DIVERSITY IN RIVER WATER NEAR TO INDUSTRIAL AREA OF PALI, RAJASTHAN

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Abstract

River water pollution is the severe problem all over the nation. Present study was conducted to analyze the quality of river water near industrial area of Pali district, Rajasthan. For this purpose samples were collected for six month from January 2019 to June 2019. These samples were tested for various physicochemical parameters according to standard protocol (APHA, 1998). These parameters includes pH, temp, hardness, DO, BOD, COD, TDS, TSS, electrical conductivity, nitrate, phosphate, chloride, carbonate, bicarbonate etc. Observed value of these parameters were very high as compared o standard value prescribed by different agencies (BIS, 1991 and WHO, 1997) that shows the polluted condition of water. Zooplankton study was conducted in different set of sample taken from same site. Low density of zooplankton diversity suggested the high level of pollution in river water.

Key words: physicochemical parameters, Hardness, conductivity, Zooplankton diversity.

Introduction

On earth, water is an essential natural resource for sustaining life and the environment (Mishra and Bhatt, 2008). Water is essential element of ecosystem because every organism in ecosystem requires waters for survival (WHO, 2004). It is essential for sustaining life on earth as well as the environment (Dikio, 2010). Further water is habitat for many aquatic organisms. Freshwater resources are very important for survival of human civilization on this planet because daily life activities totally depend on availability of water (Mishra *et al*., 2008). These water bodies are developed by human for storage of water hence they represent semi natural ecosystem (Yadav *et al*., 2013). This is the reason that human colonization occurred near water resources.

River water pollution has become severe problem in all countries. Major reasons of pollution are industrial release and sewage discharge directly into water bodies without proper treatment. They count for pollution of approx 70% of total available water (Dhirendra *et al*., 2013). Water supply system has been polluted by heavy chemicals, metals, salts and harmful microbes (Onwughara *et al*., 2013).

Water pollution is real threat to the nature because changes in the water quality in polluted aquatic ecosystem destroy biotic community present within ecosystem. Contamination of water leads to many healths hazardous effects to human as it cause infection of water born disease (Sharma *et al*., 1996). Hence pollution of fresh water bodies is great concern in all countries. Therefore the drinking water quality should be necessarily analysed at regular intervals.

Zooplanktons are Minute floating organism, generally microscopic but some large organisms are clearly visible. They are major biological units and they have very significant contribution in maintenance of aquatic ecosystem (Murugan *et al*., 1998). They occupies second tropic level hence affects various function of ecosystem such as food chain, energy flow etc. (Ramchandra, 2008). Density and diversity of zooplankton species is affected by climate change as well as change in physical and chemical characteristics of water bodies (Neves *et al*., 2003). There is direct relation between diversity of Zooplankton species and physicochemical characteristics of the aquatic environment (Brraich and Kayr, 2005). Zooplanktons are considered bio indicator species for measurement of pollution status of water bodies (Mikschi, 1989).

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Studies about changing water conditions and their impact on organisms had become significant in recent times. Analysis of physicochemical parameters gives idea about water quality and it is helpful in assessment of pollution in aquatic system. Present study was conducted to analyze the physicochemical parameters and their impact on population density and diversity of zooplankton species in river water in Pali district, Rajasthan.

Material and Methods

Pali city was selected as study area which is situated on bank of Bandi river in state of Rajasthan in western part of India. It is located at 25.77°N latitude and at 73.33ºE altitudes. Pali city is well known for textiles industries and popularly called "The Industrial City". Three different sampling sites were selected near industrial area named as sampling station I, II and III. Water sample were collected on monthly basis regularly from January 2019 to June 2019. Samples were taken in plastic bottles (0.5L and 1L) and brought to laboratory for estimation of physicochemical parameters using APHA standard methods (APHA, 1998). Plankton collection was done using plankton collecting net.

Result and Discussion

Results of the present study are given in table 1 and table 2 that represent measurement of various physicochemical parameters and occurrence of zooplankton species respectively. These results are discussed below.

Temperature value in present study shows upward trend from January to June. Desired limit of temperature to sustain life is 28-30ºC. Minimum value was recorded in January (18.4°C) and maximum was observed in June (38.5°C). The pH value ranges between 7.5 to 9.5 in water samples which indicates alkaline nature of water mainly due to carbonate and bicarbonate. According to BIS (Bureau of Indian Standard) the permissible limit of pH should be 6.5-8.5. Dissolved Oxygen (DO) value indicated the high pollution level as it was very less than the required amount (2-4mg/L) of oxygen to sustain life (Francis-Floyd 2003). The total hardness values found in range of 206-332 mg/L. The maximum value was found in May and minimum in January. Maximum recorded value of Biochemical Oxygen Demand (BOD) was 704mg/L in month of January and minimum value was 330mg/L recorded in month of May. Chemical Oxygen Demand (COD) COD value were found in range of 830-1545 mg/l in which minimum value observed in January and maximum in June. Recorded value of EC (Electrical Conductivity) were ranged from 7250 to 17800 Ω/cm. The maximum value of conductivity was found in June. Total Solids represents both dissolved solid and suspended form. Total dissolved solids (TDS)
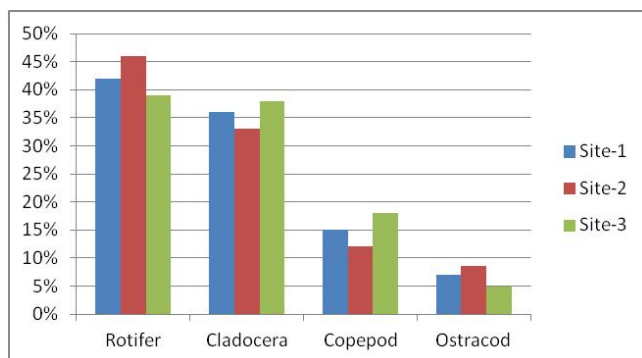
Table 1: Showing values of various physicochemical parameters during study period.

Parameters	Sampling Station	Jan 2018	Feb 2018	Mar 2018	Apr 2018	May 2018	June 2018
pH	I	8.95	8.8	9.0	8.6	7.7	7.8
	II	7.9	7.5	7.6	7.7	8.3	8.8
	III	8.5	8.8	8.9	9.1	9.2	9.2
Temp	I	19	21	30	31.3	34	38.5
	II	18.4	22	26	28.8	32	37
	III	19.5	21.8	25	29	33	38
Dissolved Oxygen (mg/l)	I	0.82	0.85	0.80	0.68	0.56	0.46
	II	0.69	0.78	0.70	0.60	0.48	0.38
	III	0.91	0.81	0.79	0.72	0.53	0.41
TSS (mg/l)	I	628	694	724	795	804	838
	II	616	592	620	656	710	728
	III	524	510	534	602	594	576
Hardness (mg/l)	I	204	224	235	242	248	266
	II	291	259	278	296	332	318
	III	241	264	288	294	308	304
COD (mg/l)	I	1020	1220	1480	1323	1490	1545
	II	830	848	1020	1228	1280	1394
	III	1124	1232	1178	1624	1140	1412
BOD (mg/l)	I	476	522	565	440	420	418
	II	470	370	420	382	330	396
	III	704	680	624	528	476	416
Electrical conductivity (μmhos/cm)	I	8000	8800	10100	10200	13700	17000
	II	7250	8700	9600	13000	14800	16500
	III	9200	8700	9500	10500	12300	14220
Chloride Conc. (mg/l)	I	1435	1510	1465	1620	1692	1700
	II	1590	1668	1675	1722	1800	1885
	III	1500	1660	1620	1700	1790	1800
Phosphate concentration (mg/l)	I	12.00	13.20	17.00	17.60	19.50	20.90
	II	11.10	10.12	9.80	10.70	10.96	13.20
	III	12.30	12.20	12.80	12.90	14.00	14.80
Nitrate concentration (mg/l)	I	83	87	92	102	112	146
	II	72	68	81	82	92	106
	III	76	82	78	80	108	102
CO_2 concentration (mg/l)	I	342	328	308	381	380	349
	II	149	138	210	226	244	256
	III	178	206	164	236	248	228
Bicarbonate concentration (mg/l)	I	161	167	149	204	258	256
	II	142	129	164	178	220	246
	III	176	159	166	162	198	210
TDS (mg/l)	I	3390	3466	3638	3900	4078	4224
	II	2820	2754	3026	3086	3166	3212
	III	3134	3024	2950	2890	3016	3032

Fig. 1: Showing distribution of Zooplankton in different sampling sites.

Table 2 : Zooplankton percentage of different groups in different sampling site.

Group	Site-1	Site-2	Site-3
Rotifer	42%	46%	39%
Cladocera	36%	33%	38%
Copepod	15%	12.5%	18%
Ostracod	7%	8.5%	5%

in present study water found in between 2754-4220 mg/L. minimum value of TDS was observed in February. Total Suspended Solid (TSS) values were found in range of 510 to 838 mg/L. Phosphate concentration was maximum in June (20.90 mg/L) and minimum was found in March (9.8 mg/L). Nitrate concentration is affected by action of microorganisms. Maximum concentration was found in June (146 mg/L) where as minimum was observed in February (68mg/L). Chloride concentration value ranged between 1435-1885 mg/L. Highest concentration observed in June and the lowest recorded value of chloride was in January. CO_2 concentration was measured in range of 138-349 mg/L where as Bicarbonate concentration was found maximum in April (258 mg/L) and minimum in February (129mg/L).

Zooplankton diversity and their abundance are directly affected by physicochemical characteristics of water (Poongodi *et al*., 2009). Identification and counting of different zooplankton species had been done regularly during study period. Four group of zooplankton were identified from collected samples (Table 2). Rotifers were the most abundant while ostracoda were least abundant. Overall maximum density of zooplankton was observed in summer (June) because increased temperature leads to increased activity of plankton (Dhanasekaran *et al*., 2017).

Conclusion

This study shows that value of different physicochemical parameters are above their permissible limit hence it indicated polluted status of water. Plankton diversity and their number were found very lesser which further indicates pollution level of water bodies. Analysis of physicochemical parameters reveals status of water quality. It provides information so that planning for cure of pollution can be done in order to avoid health hazardous effects of polluted water. Study of zooplankton species is important because that can be used as pollution indicator.

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