BIOSCIENCES BIOTECHNOLOGY RESEARCH ASIA, June 2012. Vol. **9**(1), 327-330

Seasonal Variations in Different Physico-chemical Characteristics of Ramsinghpura Pond at Rewari, Haryana

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(Received: 03 April 2012; accepted: 13 May 2012)

Present investigations were carried out on the limnological aspects of Ramsinghpura village pond in district Rewari. A total of 17 parameters were analyzed for their seasonal variations from October 2009 to May, 2010. Most of the parameters viz. Temperature, Transparency, EC, DO, Chloride, Carbonate, Bicarbonate, T.alkalinity, T.hardness, TDS and phosphate were found beyond the permissible limit while pH, calcium, magnesium, salinity and nitrate were recorded in permissible limit as prescribed by Aquaculture Pond Water standards.

Key words: Limnology, Ramsinghpura Pond and aquaculture.

Water is indispensable and one of the precious natural resources of this planet. Natural aquatic systems such as ponds, lakes, rivers or oceans form well balanced ecosystem with ambient physico-chemical conditions forming an environment on which the biotic system develops. The physico-chemical parameters of water affect the number and abundance of aquatic flora and fauna of the aquatic ecosystem. Fresh water has become a scare commodity due to over exploitation and pollution. A lot of work has been carried out on the physico-chemical and biological conditions of different aquatic habitats (Patel and Sinha, 1998; Dwivedi and Pandey, 2002 and Jyoti *et. al.*, 2004).

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To evaluate the water quality, an effort was made to find out the status of Ramsinghpura village pond used for fish culture.

MATERIAL AND METHODS

The pond is located in Ramsinghpura village, 5 Km away from Rewari Bus Stand. The pond is about four hectare in area with an average depth of about 2.5 metres during post-monsoon period. The pond is mainly used for fish culture. Uncontrolled domestic waste water from surrounding area including Ramsinghpura village and Rewari city is discharged into the pond that affects physico-chemical parameters of water leading to eutrophication and excessive algal growth.

Water samples were collected during post-monsoon, winter and summer seasons to study water quality and its seasonal variations. Water samples were collected in one liter glass stopper sterile bottles during morning hours between 8.30 a.m. to 11.30 a.m. and brought to laboratory for analysis of physico-chemical

parameters following the standard methods of Trivedi and Goel (1986) and APHA (2005). Values were compared with standards of Aquaculture Pond Water (Boyd, 1998).

RESULTS AND DISCUSSION

Values of Physico-chemical parameters of three seasons (Post-Monsoon, winter and Summer) from October 2009 to May 2010 are given in Table 1.

Temperature is considered as one of the most important factor in an aquatic ecosystem. The temperature of water varied between 16.25 to 36.00^{0}C with a maximum temperature (36.00^{o}C) in summer season and a minimum (16.25^{o}C) in winter season. There is steady rise in water temperature with the increase day length and the angle of incidence of sun rays. Sahni *et. al.,* (2011) also made similar observation in their study on Mansagar Lake.

Transparency during the present investigation ranged between 9.47 to 12.30 cms of which higher value (12.30 cm) was recorded in summer season while the lowest value (9.47cm) in post-monsoon season. Decrease in transparency during post-monsoon season indicated nutrient influx in pond. Jabeen (2002) found similar behavior of transparency in his study on Hiran Minar, Sheikhupura.

Table 1. Seasonal variation in Physico-Chemical parameters of Ramsinghpura Pond during 2009-2010

Parameters	Post-monsoon	Winter Season	Summer season	Aquaculture pond water season standards as per Boyd(1998)
Temperature(0°C)	21.00	16.25	36.00	25-32
Transparency(cms)	9.47	12.30	11.87	35-40
pH	8.23	7.93	8.35	7-9
EC(umhos/cm)	2843.50	2553.50	2763.25	2000
Free CO_2(mg/L)	-	-	-	1-10
DO(mg/L)	5.34	5.74	4.83	5-15
Chloride(mg/L)	488.12	310.62	598.72	1-100
Carbonate (mg/L)	292.00	270.00	428.00	0-20
Bicarbonate(mg/L)	520.00	373.00	1379.00	50-300
T.Alka. (mg/L)	812.00	643.00	1807.00	50-300
T.Hardness(mg/L)	368.60	334.45	422.60	50-300
Calcium(mg/L)	25.54	21.82	28.90	5-100
Magnesium(mg/L)	74.36	68.34	85.45	5-100
Salinity(ppt)	2.00	1.75	2.25	<5
TDS (mg/L)	1670.00	1391.70	2186.20	500
Nitrate(mg/L)	1.42	1.31	2.13	0.2-10
Phosphate (mg/L)	3.44	3.21	3.68	.005-0.2

pH values of water samples during the post-monsoon, winter and summer seasons were 8.23, 7.93 and 8.35 respectively. The highest value (8.35) was noticed in summer season and lowest value (7.93) in winter season. The pH is the result of the interactions of the numerous substances in solution in the water and also the numerous biological phenomenon. Upadhyay *et. al.*, (2010) stated that alkaline pH may be due to the decomposition of organic matter.

Electrical Conductivity values of water samples ranged between 2553.50 µmhos/cm to 2843.50 µmhos/cm with a maximum value (2843.50 µmhos/cm) in post-monsoon season and a minimum value (2553.00 µmhos/cm) in winter season. Conductivity of water depends upon the concentration of ions and its nutrient status and variations in dissolved solids content. The higher value of EC during post-monsoon season may be due to influx of nutrients from the catchment area. The present results are in conformity with the work of Pandey and Pandey (2003).

Free CO_2 in the present study was found absent.

Dissolved Oxygen is an important parameter of an aquatic ecosystem which is essential for the metabolism of all aquatic organisms that possess aerobic respiration. In the present study the dissolved oxygen of water sample ranged from 4.83 to 5.74 mg/l of which Maximum value (5.74 mg/l) was noted in winter season and the minimum value (4.83mg/l) in summer season. The higher values of DO during winter season may be due to circulation by cooling and draw down of DO in water (Dwivedi and Pandey, 2002). The value further depletes during summer because at high temperature, the oxygen holding capacity of water decreases. Present observations are in agreement with similar ones made by Shanthi *et. al*., (2002) and Chaurasia and Pandey (2007).

Chloride have been found to vary between 310.62 to 598.72 mg/L of which maximum value (598.72mg/L) was noticed in summer season and the lowest value (310.62 mg/L) in winter season. The little pulse during the summer may be associated with high temperature which enhances the evaporation, reducing the volume of water thus resulting in the concentration of salts. Chloride enrichment due to excreta has been reported by Raj Narayan *et. al*., (2007).

Alkalinity in water is usually caused by the carbonate, bicarbonate and hydroxyl ions and less frequently by the borates, silicates and phosphates. In the present study, the carbonate values varied from 270.00 to 428.00 mg/L with summer maxima and winter minima. An inverse relationship between the carbonate and free carbon dioxide has earlier been reported by Puri (1989). Seasonal fluctuations in bicarbonate content was maximum (1379.00 mg/L) in summer season and minimum (373.00 mg/L) in winter season. Total alkalinity values fluctuated from 643.00 to 1807.00 mg/L being higher (1807.00 mg/L) during summer season followed by steep fall (643.00 mg/L) in winter season. Larger quantities of bicarbonates during summer may be due to the liberation of carbon dioxide in the process of decomposition of bottom sediments with resultant conversion of carbonates to bicarbonates. Chaurasia and Pandey (2007) also reported similar findings in their study on some water ponds of Ayodhya- Faizabad.

Total Hardness during present investigation was recorded maximum (422.60 mg/L) in summer season and minimum (334.45 mg/L) in winter season. Patel and Sinha (1998) also noted that total hardness is mainly due to calcium, magnesium and eutrophication. Calcium values were found ranging between 21.82 to 28.90 mg/L of which maximum value (28.90mg/L) was noticed in summer season and minimum value (21.82mg/L) in winter season. Magnesium values varied from 68.34 to 85.45 mg/L of which highest value (85.45mg/L) was noticed in summer season and the lowest value (68.34mg/L) in winter season. The observed highest values of alkalinity with respect to hardness indicate the presence of basic salts, sodium and potassium in addition to those of calcium and magnesium. Calcium hardness may be due to the presence of high content of calcium and magnesium in addition to sulphate, nitrates and sewage in flow (Angadi *et. al*., 2005).

Salinity of water was found ranging between 1.75 to 2.25 ppt of which maximum value (2.25 ppt) was noticed in summer season and lowest value (1.75 ppt) in winter season. The higher value during the peak summer season perhaps may be due to greater evaporation of water and domestic activities (Abowei, 2010).

Total Dissolved Solids values were found to vary between 1391.70 to 2186.20 mg/L being maximum (2186.20 mg/L) in summer season and minimum (1391.70mg/L) in winter season. However, the concentration of dissolved solids were found to be directly proportional to the ionic strength and the increase in conductivity which may be possible due to leachate infiltration from the soil (Sastry *et. al*., 1999)

Nitrate is the most important source of biological oxidation of nitrogenous substances present in sewage, chemicals, fertilizers, decaying vegetables, leachate from refuse dumps etc. The nitrate concentration of water samples ranged between 1.31 to 2.13 mg/L. The pond exhibited maximum nitrate concentration (2.13 mg/L) during summer season whereas the minimum concentration (1.31 mg/L) during winter season. All the water samples have nitrate concentration within the permissible limits. Similar findings were observed by Majumder *et. al*., (2006) and Chaurasia and Pandey (2007).

Phosphate concentration in the present study was very high as compared to permissible

limit ranging from 3.21 mg/L to 3.68 mg/L of which maximum value (3.68 mg/L) was noticed in summer season and the minimum value (3.21 mg/L) in winter season. Basic nutrients like phosphate and nitrate determine the productivity of pond water. Any amount in the excess of 0.5 ppm of phosphate is an indicator of pollution (Jain *et. al*., 1996).

CONCLUSION

From the above investigations, it may be inferred that some of the Physico-chemical parameters like pH, Calcium, Magnesium, Salinity and Nitrate were found within the range and others viz. Temperature, Transparency, EC, DO, Chloride, Carbonate, Bicarbonate, T.alkalinity, T.hardness, TDS and Phosphate were found beyond the permissible limits prescribed by Aquaculture Pond Water Standards indicating organic pollution. Eutrophication tends to cause imbalance in the system resulting in the loss of pond production. Therefore, there is an urgent need of effective management norms for a sustainable fish production and biodiversity conservation.

ACKNOWLEDGEMENTS

The authors are grateful to the Management Committee and Principal of Vedic Kanya P.G. Mahavidhyalaya, Raja Park, Jaipur and Ahir College, Rewari for providing necessary facilities.

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