

Seasonal variations in Physico-chemical characteristics of Nirmal Lake, Vasai, Dist. - Thane, Maharashtra.(INDIA).

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Abstract: *The present study deals with assessment of the water quality of Nirmal Lake, Vasai, Dist-Thane, (M.S.)India. The physico-chemical characteristics were studied and analyzed during the period of one year. Seasonal variations at four different sites of the lake were observed. Sewage drains, cloth washing, bathing of animals, agro-waste with pesticides residue and rituals waste drains into the lake may result into the change in physico-chemical characteristics of lake water. Some parameters like pH, temperature, D. O. CO₂, Hardness, Nitrate –Nitrogen and Phosphate etc. studied throughout year. The results revealed that the condition of this lake in month wise analysis showed fluctuations in physico-chemical parameters.*

Key words- *Physico-chemical, variations, seasonal, Nirmal, lake.*

I. Introduction

Water has unique component of nature has played vital role in the life processes. Our natural resources are limited and hence water has become more precious. The property of water of dissolving and carrying suspension, a variety of chemicals has the undesirable consequences that water can easily become contaminated. Most of natural water bodies are gradually becoming degraded to a great extent due to rapid growth of industrialization and population explosion. The increasing demands of fresh water in all sectors like drinking, agriculture, industry and aquaculture. Fresh water is going to be the scarcest resources in future. Unplanned and excessive exploitation and mounting anthropogenic influence in and around aquatic ecosystem have resulted in pollution problem. According to Chandrasekhar and Kodarkar (1996) analysis conducted in 1982 revealed that about 70% of all available water in country is polluted.

Lake being the fragile ecosystem is vulnerable to such problems. Analysis of physico-chemical parameters of water is essential, to assess the quality of water for the best uses like irrigation, drinking, bathing, fishing, industrial processing and so on. The knowledge of physico-chemical properties along with its biological characteristics can provide clear idea about the trophic status of water bodies, and also detect the effects of pollution of the water quality. With favourable environmental conditions including temperature, dissolved oxygen and availability of abundant food in the form of bacteria, phytoplankton, zooplankton and suspended detritus' material (Jadhav *et.al.*2013). In India voluminous work on limnology of lentic water bodies have been carried out by Kakvipure and Yeragi, (2005); Gupte *et.al.*(2009);Shinde *et.al.*,(2010); Jadhav *et.al.*(2011); Waghmare *et.al.*, (2012); Naik *et.al.*,(2012).

II. Materials And Methods

The samples for physico-chemical analysis were collected from Nirmal lake, Vasai, at four different sites about 200 meters away from each other in pre rinsed five liter capacity polythene cans in morning between 8a.m. to 12a.m. in the first week of every month from Feb 2010 to Jan2011 from a depth of 5-10 cm below the surface of water. Separate samples were collected for dissolve oxygen in 250ml BOD bottles and dissolved oxygen was fixed in the field by adding Wrinklers A and B solution immediately after collection. The temperature and p^H were measured with the help of Thermometer and p^H pen at collection site only. The physico-chemical characteristics of the lake water like DO, CO₂, Transparency, Total alkalinity, Hardness, silica, Nitrate and Phosphate were determined in every months according to standard methods APHA(2005); Trivedi and Goel (1986).

III. Results And Discussion

Temperature: Water has unique thermal properties which combine to minimize temperature changes. It affects on biochemical reaction, population fluctuation of water body as well as physical and chemical characteristics of water. During the present investigation the surface water temperature of lake showed considerable fluctuation. The temperature varies between a January minimum of 22.2°C to a May maximum 32.2°C (Table.1). The average temperature of this lake water was 26.91 °C. The pattern of variation in water temperature was being the lowest in January. Water gradually became warmer from February onwards with maximum temperature in May (Fig.1). The present study observed that pattern of its seasonal fluctuation is similar to that of Jayabhaye,(2013) from Wadad tank of Hingoli District (M.S.).

pH: pH of surface water ranges between 7.15 to 7.98 and indicated alkaline nature of the water with an annual average of 7.55 (Table.1 and Fig.1). pH concentrations alters with seasons (Ruth *et.al.*, 2013). Similar observations were made by Gupte *et.al.*, (2009), on study of Bhorpada lake (M.S.).

Dissolve Oxygen (D.O.): Air is main source of oxygen in water and during the process of photosynthesis by aquatic plants. Oxygen distribution is important as it is the direct need of most of the organisms wherever present in the environment. It also affects the solubility and availability of many nutrients and therefore the productivity of aquatic ecosystem. The dissolve oxygen varied in the range of 5.45 to 7.79 mg/l of observations with an average of 6.72 mg/l. The fluctuation in D.O. level remained marginal during the period of present investigations.

During summer lowest values of DO may be due to high temperature and low solubility of oxygen in water consequently affecting the BOD. Further, the DO content of water was low in summer because of its enhanced utilization by microorganisms in the decomposition of organic matter (Naik *et.al.* 2012).

The seasonal physico-chemical parameters data of Nirmal lake, Vasai (M.S.) India have been presented in Table 1 and Figures 1.

Table 1-Monthly variation of Physico-chemical parameters of Nirmal Lake (Feb 2010-Jan 2011)

Months	Water Temp. (°C)	pH	DO (mg/l)	CO ₂ (mg/l)	Transparency (cm)	Total Alk. (mg/l)	Total Hard. (mg/l)	Silica (mg/l)	Nitrate (mg/l)	PO ₄ (mg/l)
Feb	23.5	7.62	5.45	3.60	105	125	45	17.22	0.106	0.05
Mar	28.1	7.50	5.71	3.80	90	135	46	12.75	0.125	0.056
Apr	30.1	7.35	6.25	4.40	85	145	55	8.40	0.090	0.085
May	32.2	7.15	6.50	4.80	75	155	56	14.60	0.120	0.082
Jun	30.4	7.21	7.56	3.80	75	175	57	17.25	0.108	0.092
July	29.2	7.63	7.79	3.50	70	180	62	21.70	0.095	0.101
Aug	27.5	7.51	7.62	2.50	110	166	65	25.80	0.075	0.09
Sep	26.3	7.55	7.35	2.40	130	176	64	24.20	0.045	0.091
Oct	25.1	7.76	7.25	2.60	160	170	60	22.10	0.035	0.075
Nov	24.8	7.77	7.05	2.30	165	140	57	17.25	0.025	0.061
Dec	24.3	7.98	6.50	2.20	160	130	51	15.25	0.065	0.042
Jan	22.2	7.65	7.72	3.9	150	120	47	17.2	0.092	0.045

Table. 2 Seasonal variations of physicochemical parameter of Nirmal Lake

Season	Water Temp. (°C)	pH	DO (mg/l)	CO ₂ (mg/l)	Transparency (cm)	Total Alk. (mg/l)	Total Hard. (mg/l)	Silica (mg/l)	Nitrate (mg/l)	Phosphate (mg/l)
Summer	28.475 ± 3.6231	7.40 ± 0.1806	5.98 ± 0.7459	4.15 ± 1.2584	135 ± 2.9814	140 ± 2.64905	50.5 ± 2.4077	13.2425 ± 2.2222	0.11025 ± 2.07390	0.0682 ± 1.9518
Monsoon	28.35 ± 1.4571	7.47 ± 0.1722	7.58 ± 0.6897	3.05 ± 3.2879	146.25 ± 2.8571	174.25 ± 2.5607	62 ± 2.3408	22.2375 ± 2.1693	0.0807 ± 2.0306	0.0935 ± 1.8814
Winter	24.1 ± 1.4166	7.79 ± 0.2274	6.63 ± 0.7143	2.75 ± 3.1234	205 ± 2.7472	205 ± 2.4807	53.75 ± 2.2792	17.95 ± 2.12	0.0542 ± 1.99	0.0557 ± 1.8490

Free carbon- dioxide: Carbon dioxide (CO₂) was in the range of 2.20 to 4.80 mg/l of observations with an average 3.31mg/l. The fluctuation in free carbon dioxide level was marginal during the entire period of study. Maximum carbon dioxide concentrations were recorded in the month of May (Table.1). Relatively lower concentrations of free carbon dioxide were recorded during most of the months (Fig.1).

Transparency: The water transparency values were ranged between 100 cm to 215 cm of observations with average of 162.18 cm. Transparency value was maximum during winter was recorded 215 cm. and minimum during monsoon 100 cm. (Table 1 Fig.1).

Total Alkalinity: Alkalinity ranged between 120 mg/l to 180mg/l. The Alkalinity values maximum during summer and lower during monsoon (Table 1 Fig.1). Alkalinity of water is mainly due to carbonates, bicarbonates and hydroxide. It is an index of nutrient status in a water body. The availability of carbon dioxide for primary

production is related to alkalinity. The total alkalinity ranged between 120 to 180 mg/l. the value was slightly higher in summer. This may be attributed to increase the rate of organic decomposition during which CO₂ is liberated, which reacts with water to form HCO₃, thereby increasing the total alkalinity in summer. The alkalinity increased during summer due to the concentration of nutrients in water. Similar observation made by Parikh and Mankodi (2012) on Sama pond, Vadodara, Gujarat, (India) and Naik *et.al.* (2012) shows higher amount of alkalinity in Kunigal lake, Tumkur, Karnataka. The decreased alkalinity was due to dilution by the rain water during monsoon.

Total hardness: Total hardness ranged between 65.0 mg/ml. maximum during the month of August while a minimum value 45.0mg/l. was during February (Table 1 Fig.1). The total hardness values varies widely as similar with findings of Parikh and Mankodi, (2012) suggested that the concentration of total hardness might be increased due to input of domestic and other sewage water in the lake. According to Jhingran (1991) soft water lakes are generally poorer in regard to their aquatic fauna and flora and usually contain less living matter per unit area than hard water lakes. Although the total mass of organisms is greater in hard water lakes while medium lakes hold a greater variety of living organisms.

Silicate-silica: The importance of silicate-silica in the production of algal growth is well recognized. In the present investigation the value ranged 8.40 (April) to 25.80 (August). The recorded values indicates more or less similar quantity of silicate-silica, which are comparable to the records by Sinha and Jha (1997) from Ox bow lakes of North Bihar.

Nitrate: It is well known fact that the role of the nitrate-nitrogen in biological productivity of aquatic ecosystem. In an aquatic environment, nitrogen is present in combined forms of ammonia, nitrite, nitrate, urea and dissolved organic compounds nitrate ranged between 0.025 to 0.0125 mg/l. (Table 1 Fig.1). The marked increase in the nitrate-nitrogen level was observed during months of March and May probably due to decomposition of macrophytes. Shinde *et.al.* (2010) reported seasonal variations of nitrate level in Harsool-Savangi dam Dist-Aurangabad, (M.S)

Phosphate: Phosphorus is an essential nutrients for primary producer, hence act as one of the limiting factors in the process of eutrophication and lakes can be aesthetically classified into good, fair and bad on the basis of % phosphates loading (Edmondson, 1991). In natural water, phosphorus is present in very small quantities. The main supply of phosphorus only in natural water is from the withering of phosphorus bearing rocks and leaching of the soils of the catchment area by rain. Generally excess of this nutrients through untreated domestic sewage and agricultural runoff (Malathi, 1999). Lack of phosphorus content of more than 0.20 mg/l are likely to be quite productive (Jhingran, 1991). The phosphate-phosphorus was recorded in the range of 0.042 to 0.101 mg/l of observations with an average of 0.072 mg/l. The phosphate values maximum during monsoon 0.101 mg/l and minimum during summer, 0.056mg/l (Table.1 Fig.1). Similar observations were made by Lendhe and Yeragi (2004) from Phirange Kharbau lake, Maharashtra and Parikh and Mankodi (2012) on Sama pond, Vadodara, Gujarat, (India). During monsoon period the value of phosphate might be high due to rain water came from agricultural fields and mixed with the influx water of the lake.

In the present investigation an attempt was made to generate base line information about some physico-chemical characteristics and quality of Nirmal lake water in different season. The winter, summer and monsoon seasons shows seasonal fluctuations in various physico-chemical parameters. The water of present lake is utilized for irrigation, washing of cloths, fish culture and rituals. The water parameters indicate that the lake is rich in nutrients.

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