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A Study on Water Quality Index of Gauripada pond, Kalyan, Maharashtra

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Abstract:-

The present paper deals with the seasonal study of physico-chemical parameters of Gauripada pond, Kalyan, Maharashtra and to calculate water quality index (WQI) which will helps to understand quality of water. Water Quality Index, represents water quality in terms of index number, which is useful representation of overall quality of water for public as well as government authority to understand status of water body for their management. In the present study water quality index was calculated on the basis of seasonal study of physico-chemical parameters like pH, electrical conductivity, total dissolved solids, suspended solids, alkalinity, hardness, chloride, nitrate, dissolved oxygen and biological oxygen demand.

Key words:-*Gauripada pond, physico-chemical parameters, Water quality. WQI, hydrology*

Introduction:-

Water is one of the important and abundant natural resource present on earth and useful for every life on the earth. Around 70% of earth surface is covered with water resources. Due to increased human population, industrialization, agricultural runoff and anthropogenic activities creating pressure on water resource and are main reasons for degradation of water resources.

Ponds are one of the important water resources used in this area. On the other hand, they also provide a habitat for invertebrates, fishes and aquatic birds (Kumar et al 2006). During recent years there has been increasingly greater concern for inland fresh water resources, which are affected in different ways by all kinds of anthropogenic activities. Therefore scientific study needs to review strategies for conservation and better utilization of ponds.

Gauripada ponds namely located in KalyanTaluka ($19^{o}15'07.1"$N and $73^{o}08'57.0"$ E) of Thane District, Maharashtra, India. The total area of this taluka is 710 Km^2. The Kalyantaluka is cubular in form, and in its western part a rich open plain. In the south and east ranges of hills running parallel with the boundary line, throw out spurs into the heart of plain. The climate is not very hot. The temperature ranges between 21.93^{0}C to 31.72^{0}C. It receives average rainfall 2355.2 mm.

Water quality index provide single to understand status of water. Hence water quality index help us to convert complex water quality data into understandable information for public. This WQI of any water body will help us

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to plan strategies to manage and conserve this natural resource. Hence attempt is made to study physico-chemical parameters of Gauripada pond to analyze WQI to understand quality status of this pond.



Plate-1Gauripada Pond



Plate- 2 Map Showing Gauripada Pond- Kalyan

Materials and Methods:-

For the present study water samples from Gauripada pond were collected seasonally from Summer 2015 to winter 2016 (February 2015 to January 2016). Water samples were collected from different sites, at the boundaries of pond and not from central region of pond as to reach in center of pond, boat facility was not available.

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The water samples were collected seasonally, in early morning hours. Clean plastic 2 litre carboys were used to collect water samples. Ten physicochemical parameters were analyzed.pH and electrical conductivity were recorded on the spot and sample for DO also collected in BOD bottle and fixed immediately and analyzed on the spot. Water analysis was performed as per the methods described in standard methods (APHA, 1992); Trivedi and Goel (1984) and Kodarkar (1992).

In this study, for the calculation of water quality index, some important parameters were selected. The WQI has been calculated by using the standard of drinking water quality recommended by the Bureau of Indian Standards (BSI), Indian Council for Medical Research (ICMR) and World Health Organization (WHO). The weighted arithmetic index method has been used for the calculation of WQI of water body. Further, quality rating or sub index (q_n) was calculated by using following expression (Jena e*t.al.*, 2013).

$q_n = 100 \times [Vn-Vo] / [Sn-Vo]$

Here, q_n = Quality rating for the nth water quality parameter.
Vn = Estimated value of the nth parameter at a given sampling station.
Sn = Standard permissible value of the nth parameter.
Vo = Ideal value of nth parameter in a pure water. (Ideal value for all parameters= 0.0 except pH and DO i.e. 7 and 14.6 respectively)
Unit weight was calculated by a value inversely proportional to the recommended standard values Sn of the corresponding parameters.
$Wn = K/S_n$
Where, Wn = Unit weight for the nth parameter.
Sn = Standard value for nth parameter.
K = Constant for proportionality
The overall Water Quality Index (W.Q.I) was calculated by aggregating the quality rating with the unit weight linearly.
$WQI = \Sigma qnWn/\Sigma Wn$

Table 1- Water Quality Index (WQI) and status of water quality (Chatterji and Raziuddin, 2002)

Water Quality Index	Water Quality Status
0-25	Excellent water quality
26-50	Good water quality
51-75	Poor water quality
76-100	Very poor water quality
>100	Unsuitable for drinking

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Table 2 - Drinking Water Standard recommending agencies and unit weights. (All values except pH and electrical conductivity are in mg/L)

Sr. No.	Parameters	Standards	Recommended Agency	Unit Weight
1	pH	6.5-8.5	ICMR/BIS	0.2190
2	Electrical Conductivity	300	ICMR	0.371
3	Total Dissolved Solids	500	ICMR/BIS	0.0037
4	Total Suspended Solids	500	WHO	0.0037
5	Total Alkalinity	120	ICMR	0.0155
6	Total Hardness	300	ICMR/BIS	0.0062
7	Chloride	250	ICMR	0.0074
8	Nitrate	45	ICMR/BIS	0.0412
9	Dissolved Oxygen	5	ICMR/BIS	0.3723
10	Biological Oxygen Demand	5	ICMR	0.3723

Result and Discussion:-

Table-3 Seasonal variation of the physicochemical parameters of the Gauripada pond for the year 2015-16

Parameters	Summer-15	Monsoon-15	Winter-16
pH	7.98	7.94	7.88
E.Conductivity (us)	430.00	397.50	500.00
TDS (mg/l)	237.50	193.75	325.00
SS (mg/l)	60.00	145.00	155.00
Alkalinity (mg/l)	225.00	100.00	281.25
Hardness (mg/l)	342.50	168.75	166.25
Chlorides (mg/l)	226.05	101.95	212.75
Nitrates (mg/l)	0.43	0.27	0.79
DO	5.72	7.03	5.62
BOD (mg/l)	6.05	7.05	3.53

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Table-4 Calculation of Water Quality Index

Parameters	Unit Weight (Wn)	Summer-2015		Monsoon-2015		Winter-2016	
		Quality Raring (q_n)	Wnq_n	Quality Raring (q_n)	Wnq_n	Quality Raring (q_n)	Wnq_n
pH	0.22	65.33	14.31	62.67	13.72	58.67	12.85
E.Conductivity (us)	0.37	143.33	53.18	132.5	49.16	166.67	61.83
TDS (mg/l)	0	47.5	0.18	38.75	0.14	65	0.24
SS (mg/l)	0	12	0.04	29	0.11	31	0.11
Alkalinity (mg/l)	0.02	187.5	2.91	83.33	1.29	234.37	3.63
Hardness (mg/l)	0.01	114.17	0.71	56.25	0.35	55.42	0.34
Chlorides (mg/l)	0.01	90.42	0.67	40.78	0.3	85.1	0.63
Nitrates (mg/l)	0.04	0.95	0.04	0.6	0.02	1.75	0.07
DO	0.37	92.5	34.44	78.12	29.08	93.54	34.82
BOD (mg/l)	0.37	121	45.05	141	52.49	70.6	26.28
	$\sum Wn=1.41$	$\sum q_n=874.70$	$\sum Wnq_n=151.51$	$\sum q_n=663.00$	$\sum Wnq_n=146.68$	$\sum q_n=862.12$	$\sum Wnq_n=140.83$
		WQI=107.45		**WQI=104**		**WQI=99.87**	

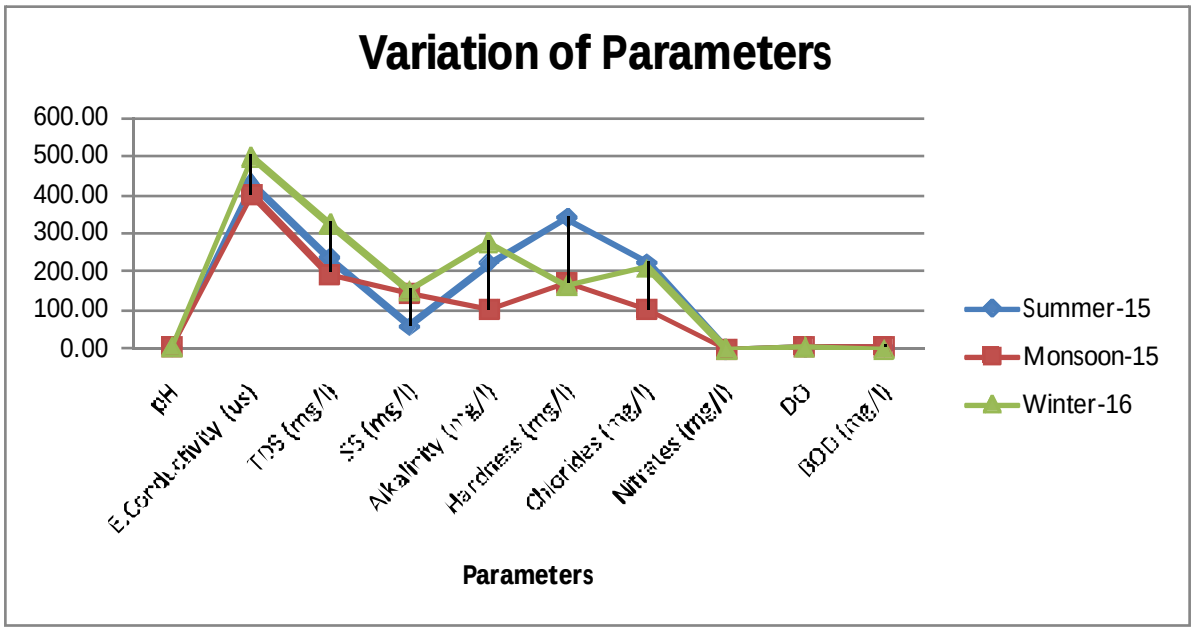

Fig:-1 Season wise variation of physicochemical parameters

pH:-

During the present study values of pH recorded in the range of 7.88 to 7.98 (Table-3). Higher value of pH recorded in summer whereas lower value recorded in winter. Saxena and Chauhan (1993) also reported higher

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pH values in summer at Yamuna river in Agra. According ICMR standard pH of water body within permissible limit i.e. 6.5 to 8.5 (Table-2) but slightly alkaline in nature.

Electrical Conductivity:-

Electrical conductivity of Gauripada pond recorded in the range of 397.5 to 500 us (Table-3). Higher value recorded in winter and lower value recorded in monsoon. The lowest value of electrical conductivity recorded in the monsoon season may due to surface flow as flow is not constant during monsoon and hence variation in the electrical conductivity value observed in monsoon. During winter discharge of surface water not possible but may be due to deposition of ions during monsoon and inlet of drainage system contribute to higher value of electrical conductivity in this season. Values of electrical conductivity for all seasons were beyond permissible limit according to ICMR limit i.e. 300 us (Table-2).

Total Dissolve Solids:-

Total dissolved solids recorded in between the range of 193.75 to 325 mg/L (Table-3). Higher value of TDS recorded during winter season while lower value recorded in monsoon season. The concentration is high which may be due to addition of solids from runoff water, sewage, municipal effluents and other domestic effluents directly to the pond (Jain *et.al*. 1996). Total dissolve solids recorded within permissible limit of ICMR i.e. 500 mg/L (Table-2).

Suspended Solid:-

During present investigation suspended solids recorded in the range of 60 to 155 mg/L (Table-3). Maximum suspended solids were recorded in the winter season whereas minimum value of suspended solid recorded in the summer season. According to WHO standard suspended solids recorded in this pond were within permissible i.e. 500mg/L (Table-2).

Total Alkalinity:

Total alkalinity recorded in the range of 100 to 281.25 mg/L (Table-3). Maximum value recorded during winter season and minimum value recorded during monsoon. Highest value of alkalinity observed during winter season may due to decomposition of organic matter and liberation of CO_2 during decomposition process. Value of alkalinity recorded during present study found to be beyond permissible limit in summer and winter season i.e. 120 mg/L (Table-2).

Total Hardness:-

During this present investigation total hardness was recorded in the range of 166.25 to 342.5 mg/L (Table-3). Highest value total hardness was recorded during summer season while lowest value was recorded in winter season. Koshy and Nayar (2000) reported higher values in post monsoon and pre monsoon period at Pambariver. During summer season water from water bodies gets evaporated which may increase concentration of chemical constituents and also degradation of sediments during summer due to wind action may contribute to calcium and magnesium ions into water bodies which may led to increase in concentration of total hardness of water. Values of total hardness during summer seasons were beyond permissible limit according to ICMR limit i.e. 300mg/L (Table-2).

Chloride:-

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Concentration of chloride recorded in the range of 101.95 to 226.05 mg/L (Table-3). Minimum concentration of chloride observed during monsoon whereas maximum was recorded during summer season. In present study chlorides did not exceed the permissible limit as per ICMR i.e. 250 mg/L (Table-2) standard indicating water body was unpolluted by organic waste.

Nitrate:-

The values of nitrates in present study fluctuated from 0.25 to 0.79 mg/L (Table-3). highest value of nitrate recorded during winter season while lowest value recorded during monsoon season. Korgaonkar*et. al.*(2014) observed similar observation in Osargaon-Ghonsari pond, Kankavli, Maharashtra. In present study all the eight stations shows concentration of nitrate within desirable limit according to ICMR standard i.e. 45 mg/L (Table-2).

Dissolved Oxygen:-

In the present study dissolved oxygen recorded in the range of 5.62 to 7.03 mg/L (Table-3). maximum value recorded during monsoon season whereas minimum value recorded during winter season.

Action of rain water during monsoon may be helps to increase concentration of oxygen. As water falling from height in the water bodies may contribute high amount of oxygen. According to ICMR standard dissolved oxygen found beyond permissible limit i.e. 5mg/L (Table-2).

Biological Oxygen Demand:-

Biological oxygen demand recorded during present study in the range of 3.53 to 7.05 mg/L (Table-3). Higher value of BOD observed during monsoon season whereas lower value recorded during winter season. Maximum value of BOD recorded during monsoon may due to surface runoff water carries debris and other organic matters which may require higher amount of oxygen for their degradation. As per ICMR standard amount of BOD recorded during present study was beyond permissible limit during summer and monsoon season i.e. 5mg/L (Table-2).

Conclusion:-

From the above results its indicate that maximum physicochemical parameters were found beyond permissible limit according to ICMR, BIS and WHO standard. The Water Quality index obtained for the water body in different seasons during study period i.e. summer season- 107.45, monsoon season- 104 and winter season – 99.87, which indicates the poor quality of water (Table-1 and Table-4). According to WQI analysis, it shows that Gauripada pond is eutrophic and water of this pond is not suitable for human consumption. It is also observed that pollution load is higher during summer as it compare with monsoon and winter. Hence it is require planning some strategies to enhance quality of water for drinking purpose and management of pond.

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