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EVALUATION OF WATER QUALITY OF POND WATER FROM VASHI, NAVI MUMBAI

Komal Bhojwani, Abhiman Janbhare and *Dr. Smita Tandale

Department of Chemistry, Karmaveer Bhaurao Patil College, Vashi, Navi Mumbai.

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***Corresponding Author**
Dr. Smita Tandale
Department of Chemistry, Karmaveer Bhaurao Patil College, Vashi, Navi Mumbai.

ABSTRACT

Wastewater problem is a never ending hot issue since fast growing industries in developing countries have serious impact on wastewater contamination. To know the status of water its characterization is necessary. Physico-chemical analysis of pond water samples from two different sites with respect to food stalls, boarding houses, residential colonies, laboratories and industrial area of Vashi, Navi Mumbai district were carried out for the period from July 2015- April 2016. The samples were collected were analyzed according to APHA. The water quality parameters studied for the current study were pH, conductance, acidity, total alkalinity, dissolved oxygen, chloride, ammonia contents, calcium, magnesium, Total Dissolved Solids (TDS), Total Suspended Solids (TSS) and total hardness. The aim of the present study is to assess the quality of water of ponds. The Total Dissolved Solids and Calcium hardness values changes due to biological activity and industrial contamination. The value of both in the present study lies well above the permissible limit.

KEYWORDS: Pond water sample, TDS, Physico-Chemical characteristics of water; Navi Mumbai district; Water Quality.

INTRODUCTION

Water is very precious for every living organism on this earth. Water is one of the most important compounds of the ecosystem. It is necessary for survival of all living things on planet, Industrial, domestic and agricultural purposes. The available fresh water to man is hardly 0.3 to 0.5% of the total water available on the earth and therefore its judicious use is imperative. India receives about 1400-1800 mm of rainfall annually and about 96% of this water is used for agriculture, 3% for domestic use and 1% for industrial activity. In today's

scenario, unplanned urbanization, rapid industrialization and indiscriminate use of artificial chemicals cause of heavy and varied pollution in aquatic environment leading to deterioration of water quality. Of these water resources due to use of contaminated drinking water, human population suffers from water borne diseases and depletion of aquatic fauna.

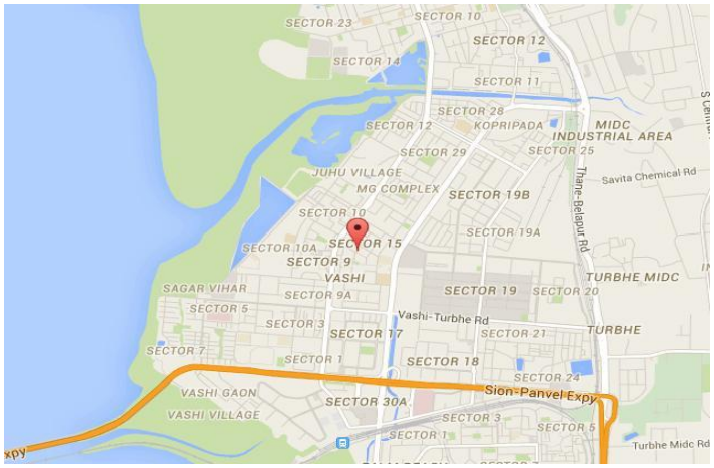
Physicochemical characteristics are highly important with regard to the occurrence and abundance of species. Discharge of urban, industrial and agricultural wastes has increased the quantum of various chemicals that enter the receiving water, which considerably alter their physicochemical characteristics.

Nutrients like phosphorous and nitrogen from domestic wastes and fertilizers accelerate the process of eutrophication. Natural factors like dust, storm, runoff and weathering of minerals are slow processes in causing eutrophication. Eutrophication has become a widely recognized problem of water quality deterioration. Turbidity, pH, temperature, conductance, dissolved oxygen, chloride and total alkalinity are significant parameters used to study the water quality. The present study involves the analysis of water quality with reference to physicochemical characteristics of pond water from Vashi, Navi Mumbai, India.

MATERIALS AND METHODS

Wastewater sample from ponds were collected in polyethylene bottles during the period of *July 2015 to April 2016* from two different stations sampling ponds. Twelve Physico-Chemical parameters were analyzed by standard methods. pH was measured using pH meter with glass electrode. The electrode was calibrated against pH 4.0, 7.0 and 9.2 buffers each time before analysis. The Dissolved Oxygen (DO) in the sample was immediately fixed with 2mL of potassium iodide and 2mL of manganous sulphate in the field itself. The DO content was determined by Winkler's method. Immediately after the samples were bought to the laboratory, estimation of calcium, magnesium, total hardness, acidity, alkalinity, chloride, nitrate and ammonia were carried out.

In the central tip of India map, lies Navi Mumbai, Thane district. It is surrounded by residential colonies and industrial commodities. For the present study the ten water sample from two different points of Navi Mumbai district were collected and analyzed for their water quality.



Parameter	Standard Limits	Mean	
		Pond-1	Pond-2
pH	6.5-8.5	5.65	5.8
Electrical Conductance	300-1500 (µS/cm)	303.71 (µS/cm)	336.08 (µS/cm)
Total Hardness	300-600 (mg/L)	169.6 (mg/L)	184.41 (mg/L)
T D S	500-2000 (mg/L)	1480 (mg/L)	1720 (mg/L)
T S S	200-800 (mg/L)	635 (mg/L)	580 (mg/L)
Dissolved Oxygen	4.0 - 7.0 (mg/L)	2.4 (mg/L)	2.52 (mg/L)
Calcium	75-200 (mg/L)	147 (mg/L)	160.45 (mg/L)
Magnesium	30-100 (mg/L)	21.33 (mg/L)	24.56 (mg/L)
Chloride	250-1000 (mg/L)	157.5 (mg/L)	173.31 (mg/L)
Ammonia	0.0 - 2.0 (mg/L)	0.28 (mg/L)	0.24 (mg/L)
Alkalinity	200-600 (mg/L)	50.7 (mg/L)	67.32 (mg/L)
Acidity	2.0 – 6.0 (mg/L)	4.37 (mg/L)	4.46 (mg/L)

Description of sample sites

Samples	Description of sampling sites
Pond 1	Surface water sample from Vashi, Navi Mumbai
Pond-2	Surface water sample from Turbhe, Navi Mumbai

P1 – Vashi sampling site, Navi Mumbai

P2 – Turbhe sampling site, Navi Mumbai

RESULTS AND DISCUSSION

The water quality parameters were analyzed as per standard methods and the results are as follows:

1.1 pH

Usually pH of water changes due to biological activity and industrial contaminations. The pH ranged from 6.9 to 7.4 during the study period. pH dropped to slightly acidic in the months of July 2015 in both the sampling stations and kept fluctuating till September 2015 of the month in the entire stretch of the ponds. The value of pH in the present study lies within the permissible limit.

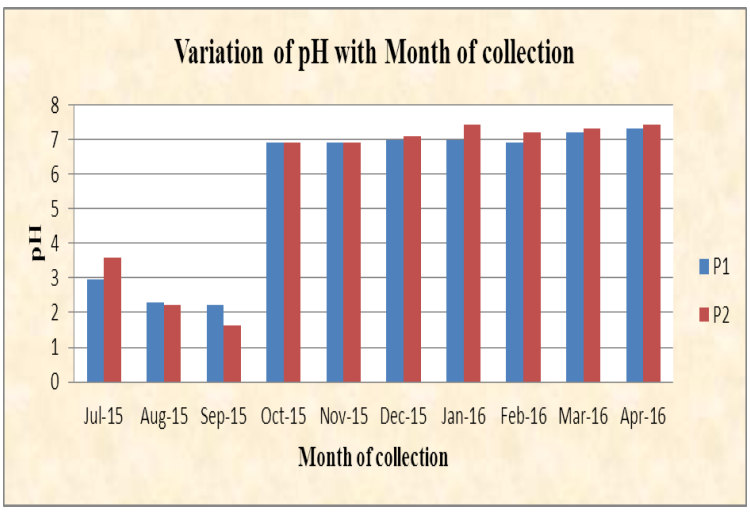


Fig 1: Variation of pH with month of collection

1.2 Electrical Conductivity

The electric current carrying capacity of water is measured in terms of conductivity; it signifies the amount of total dissolved salts. Conductivity increases as the dissolved salts concentration increase. The electrical conductivity recorded ranged from 350 to 430µS/cm for pond samples during the study period. The value of conductivity is within the standard limit.

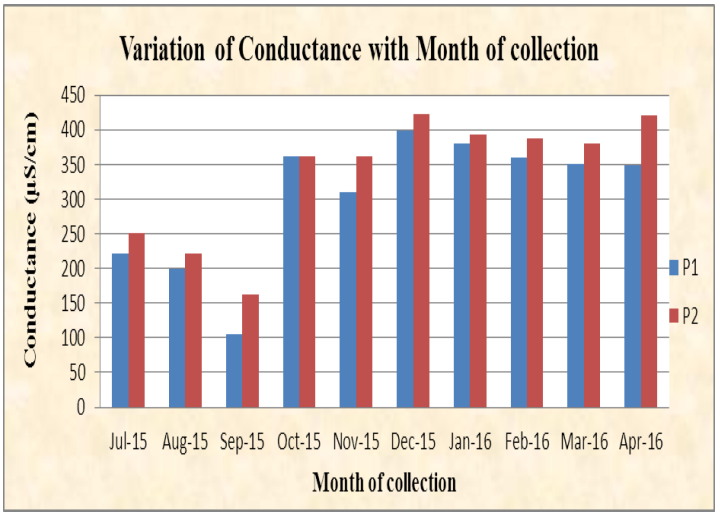


Fig 2: Variation of conductivity with month of collection

1.3 Total Hardness

Hardness in water sample is mainly due to concentration of Ca & Mg salts. They enter the water body mainly due to industrial and domestic effluence. All the four parameters exhibited similar patterns. Lower range of values for all above parameters were noted in decreasing order of TH > CaH > Ca > Mg. As calcium and magnesium bond with carbonates and bicarbonates, alkalinity and water hardness are closely interrelated and produce similar measured levels. The hardness of water is not a pollution parameter but indicates water quality. The present study lies between the permissible limit.

In the present investigation, total hardness level varied from 100.0mg/L to 230.0 mg/L and included under moderately hard to hard category. Higher values of hardness were observed during winter end months which may be due to low water level and high rate of decomposition, thus concentrating the salts. The values of hardness suggest the higher temporary hardness than permanent hardness in the ponds. Hence, proper treatment could help in reduction of total hardness.

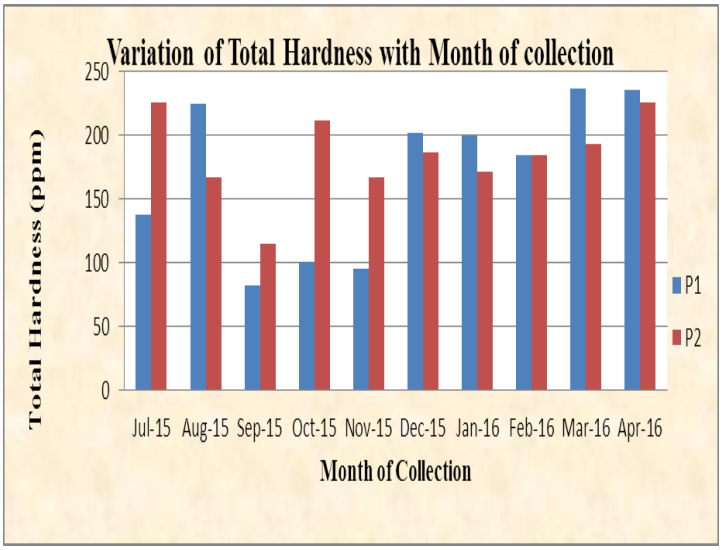


Fig 3: Variation of Total Hardness with month of collection

1.4 Calcium Hardness

Calcium is one of the most abundant substances of the natural waters. Being present in higher quantities in rocks, it is leached from these to contaminate water. Calcium is an important element is associate different cations like carbonates, bicarbonates and fluorides to exert hardness. The presence of **Calcium** in water is mainly due to the dissolution of rocks. The presence of lesser concentration reduces the corrosion in water pipes. The calcium value fluctuated from 100.0ppm to 200.0ppm in pond-2 and is high when it is compared with pond-1; the values are depicted in Table-2. The calcium value of the present study is above the desirable limit.

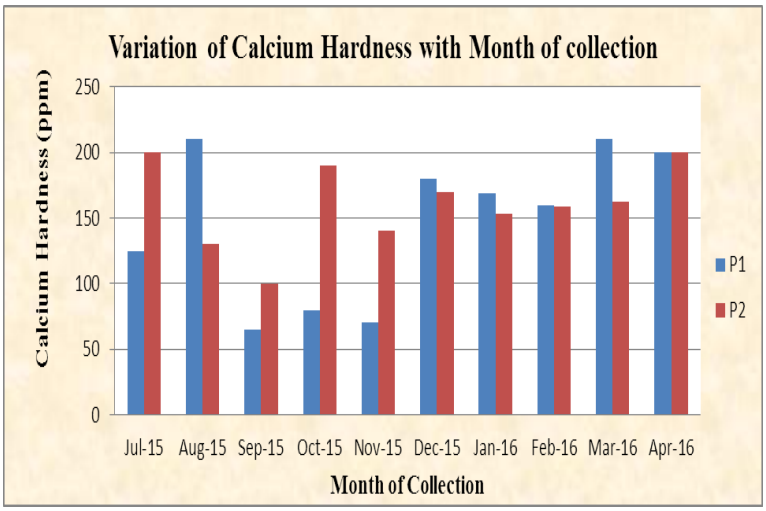


Fig 4: Variation of Calcium Hardness with month of collection

1.5 Magnesium Hardness

Magnesium hardness in water body is due to the presence of sulphate ions in it. The presence of sulphate ions at higher concentration causes laxative effect on persons who consumes it. Magnesium content is lower than the calcium ions in natural water and also follows the same trend in ponds. However, but due to the addition of animal manures and other waste in the water bodies, this increases the values of magnesium i.e., 12.5 ppm to 31.5 ppm, these elements increases hardness of water. The value of the present study is within the standard limit.

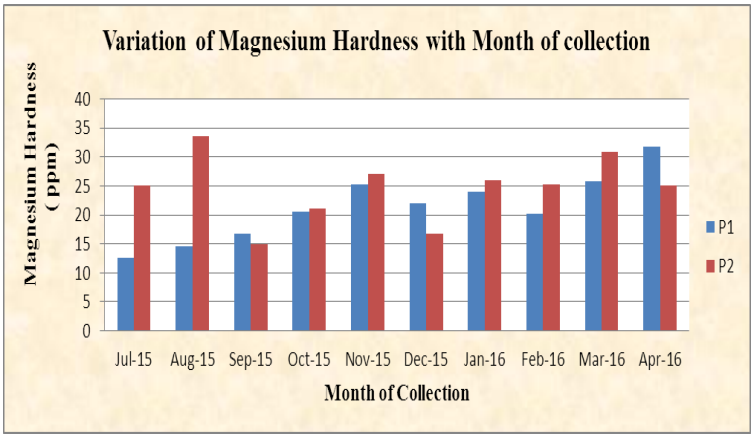


Fig 5 Variation of Magnesium Hardness with month of collection

1.6 Total Dissolved Solids (TDS)

The total dissolved solids concentrations recorded ranged from 1200mg/L to 2500mg/L for pond samples. Total dissolved solids indicate the salinity behavior of groundwater. Water containing more than 500mg/L of TDS is not considered desirable for drinking. TDS in the water sample does not cause harm to humans but at higher concentration it may cause heart and kidney diseases. TDS values of the present study are above the standard limit prescribed.

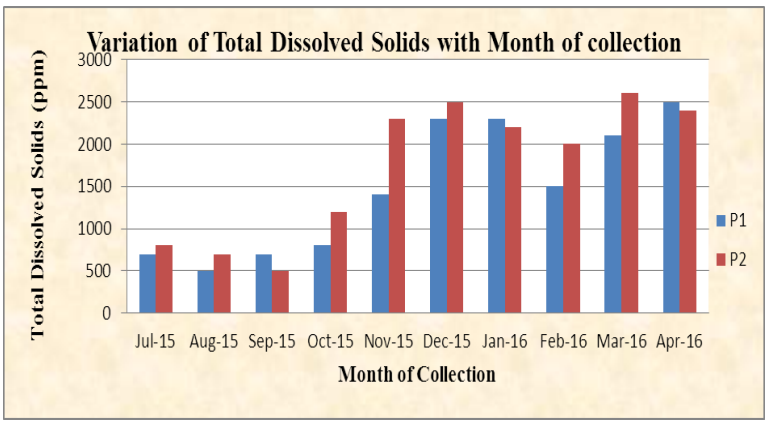


Fig.6 Variation of TDS with month of collection

1.7 Total Suspended Solids

TSS in the water sample does not cause harm to humans but at higher concentration it may cause heart and kidney diseases. TSS values of the present study are within the permissible limit prescribed.

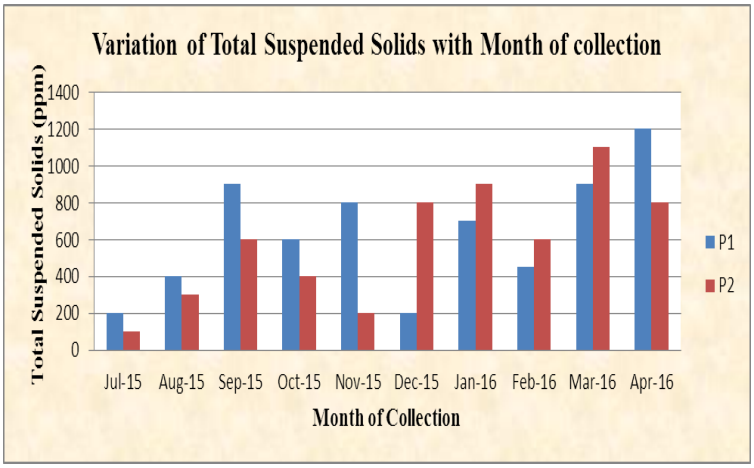


Fig 7: Variation of TSS with month of collection

1.8 Dissolved oxygen (DO)

Dissolved oxygen (DO) plays an important role in aquatic environment and is essential for metabolism of all aquatic organisms. DO content in water body is mainly due to direct diffusion from air and also due to photosynthetic activity of autotrophs. In the present study, DO is ranged between 1.2 ppm to 6.0 ppm and maximum DO was observed in the post-monsoon month at pond-2. Further, concentration of DO is inversely proportional to temperature at a given time and the present investigation resembles their observations indicating that the higher temperature of water decreased the solubility of oxygen at all the ponds. Here DO values of the present study lies within the desirable limit.

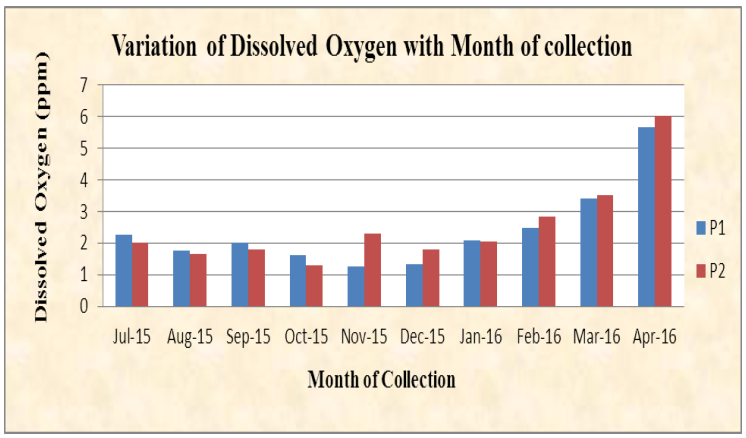


Fig. 8 Variation of DO with month of collection

1.9 Alkalinity

The main sources of alkalinity in water body are mainly due to weathering of rocks containing carbonate, bicarbonate and hydroxide compounds that are abundantly present. Higher alkalinity causes bitter taste to water. The alkalinity of 2 site's pond water, the values of the present investigation noted highest alkalinity at pond-2 and it was noted between 90mg/L to 200mg/L during the study period. There is a remarkable deterioration of the aquatic environment and increased vulnerability of life in vicinity of study areas. Alkalinity is not found from November 2015 to April 2016.

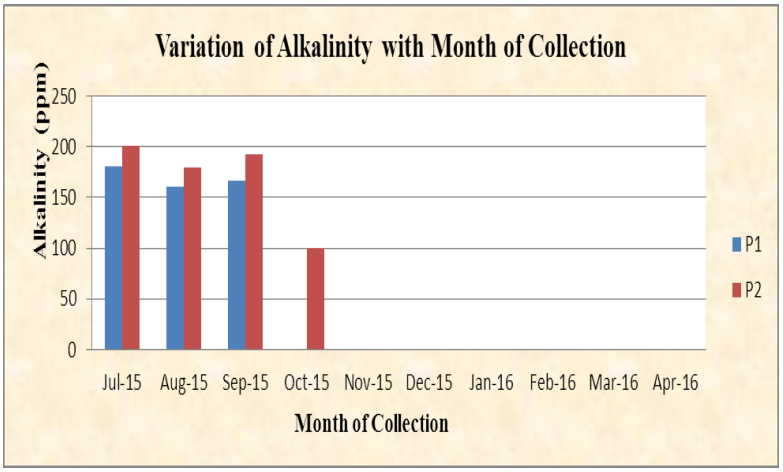


Fig 9: Variation of Alkalinity with month of collection

1.10 Acidity

Acidity of water sample is due to the presence of free acid or due to the hydrolysis of metal salts present. The acidity can be determined by titrating with both phenolphthalein and methyl orange indicator. The total acidity of the water samples study lies within the desirable limit.

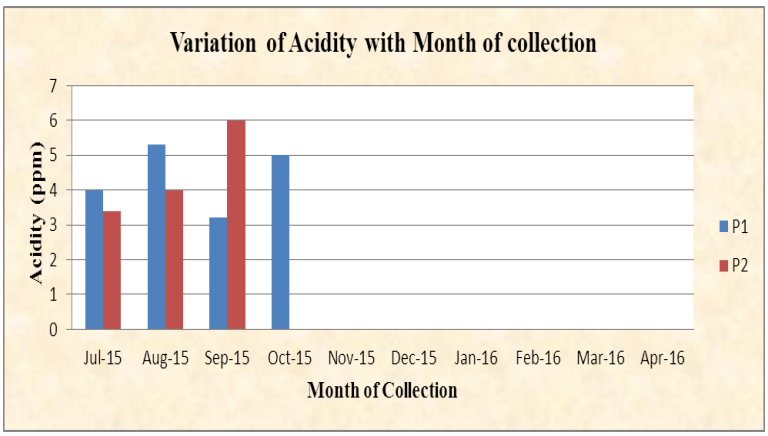


Fig 10: Variation of Acidity with month of collection

1.11 Chloride

The presence of chloride is an indicator of organic pollution. The presence of chloride in water body is mainly due to discharge of domestic sewage, industrial effluents and agricultural fertilizers. The chloride content is varied from 50.0 ppm to 280.0 ppm in pond-1, while in pond-2 its content ranged from 69.0 ppm to 260.0 ppm, show chloride content is below than the maximum permissible limit prescribed by the WHO standards.

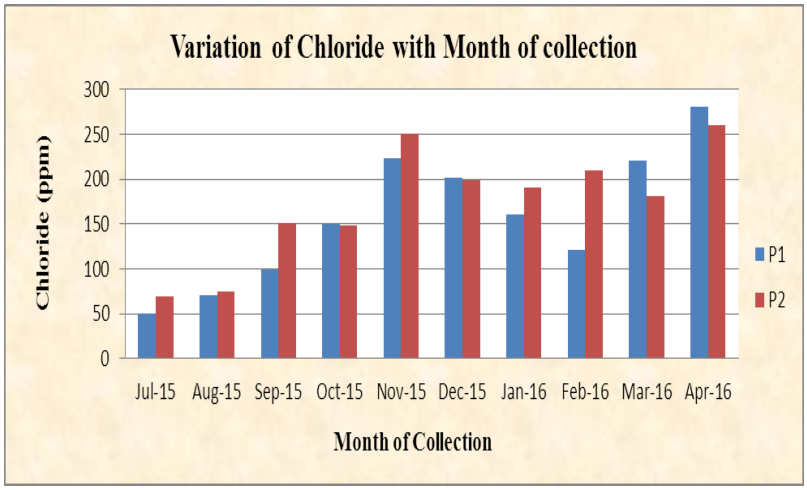


Fig 11: Variation of Chloride with month of collection

1.12 Ammonia

Ammonia is nitrogen waste released by aquatic animals into the production of pond environment. Ammonia is toxic to aquatic life and toxicity is affected by pond pH. Ammonia toxicity increases as temperature rises. The value of the present study lies well below the standard limit of pond water sample.

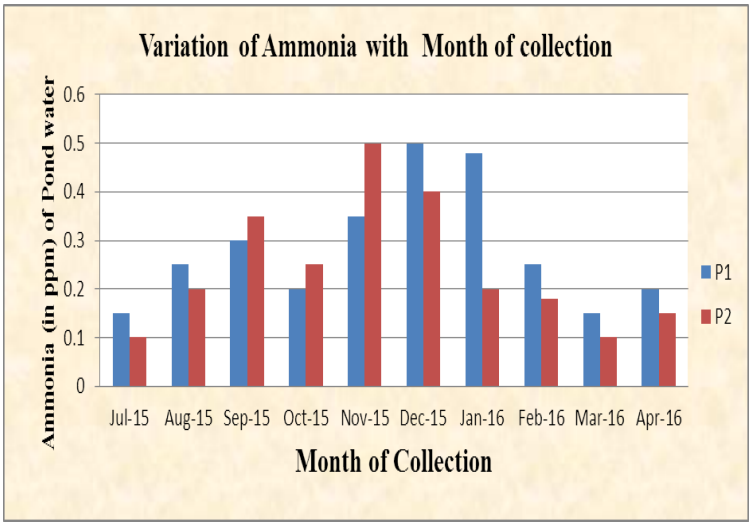


Fig 12: Variation of Ammonia with month of collection

TABLE 1: Monthly variations in Physico-chemical characteristics of Pond-1 at Vashi, 2015-16

Parameter	July 2015	Aug 2015	Sept 2015	Oct 2015	Nov 2015	Dec 2015	Jan 2016	Feb 2016	Mar 2016	April 2016	Standard Limits
pH	2.94	2.3	2.21	6.9	6.9	7.0	7.0	6.9	7.2	7.3	6.5 - 8.5
Electrical Conductance	221.0	200.2	106.0	362.0	309.3	398.5	380.8	360.0	350.8	348.5	300 - 1500 (µS/cm)
Total Hardness	137.6	224.5	81.8	100.5	95.2	202.0	199.0	184.6	235.8	235.0	300 - 600 (ppm)
T D S	700	500	700	800	1400	2300	2300	1500	2100	2500	500 - 2000 (ppm)
T S S	200	400	900	600	800	200	700	450	900	1200	200 - 800 (ppm)
Dissolved Oxygen	2.25	1.75	2.0	1.62	1.25	1.32	2.10	2.48	3.42	5.66	4.0 - 7.0 (ppm)
Calcium	125	210	65	80	70	180	169	160	210	200	75 - 200 (ppm)
Magnesium	12.6	14.5	16.8	20.5	25.2	22.0	24.0	20.2	25.8	31.7	30 - 100 (ppm)
Chloride	49.63	70.2	99.26	150.0	223.3	200.8	160.5	120.8	220.4	280.0	250 - 1000 (ppm)
Ammonia	0.15	0.25	0.30	0.20	0.35	0.50	0.48	0.25	0.15	0.20	0.0 - 2.0 (ppm)
Alkalinity	180.17	160.2	166.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	200 - 600 (ppm)
Acidity	4.0	5.3	3.2	5.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0 - 6.0 (ppm)

TABLE 2: Monthly variations Physico-chemical characteristics of Pond-2 at Turbhe, 2015-16

Parameter	July 2015	Aug 2015	Sept 2015	Oct 2015	Nov 2015	Dec 2015	Jan 2016	Feb 2016	Mar 2016	April 2016	Standard Limits
pH	3.59	2.21	1.62	6.9	6.9	7.1	7.43	7.2	7.32	7.42	6.5-8.5
Electrical Conductance	251.0	221.0	162.1	362.0	362.0	422.0	393.2	387.5	380.0	420.0	300-1500 (µS/cm)
Total Hardness	225.0	166.6	115.0	211.0	167.0	186.8	171	184.2	192.5	225.0	300-600 (ppm)
T D S	800	700	500	1200	2300	2500	2200	2000	2600	2400	500-2000 (ppm)
T S S	100	300	600	400	200	800	900	600	1100	800	200-800 (ppm)
Dissolved Oxygen	2.0	1.65	1.80	1.30	2.30	1.80	2.05	2.83	3.52	6.0	4.0 - 7.0 (ppm)
Calcium	200	130	100	190	140	170	153	159.2	162	200.3	75-200 (ppm)
Magnesium	25.0	33.6	15.0	21.0	27.0	16.8	26.0	25.3	30.9	25.0	30-100

											(ppm)
Chloride	69.5	74.45	150.6	148.86	250.0	198.52	190.50	210.2	180.48	260	250-1000 (ppm)
Ammonia	0.10	0.20	0.35	0.25	0.50	0.40	0.20	0.18	0.10	0.15	0.0 - 2.0 (ppm)
Alkalinity	201.0	179.2	192.5	100.5	0.0	0.0	0.0	0.0	0.0	0.0	200-600 (ppm)
Acidity	3.4	4.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0 – 6.0 (ppm)

CONCLUSION

Deterioration of water quality and eutrophication are due to the addition of organic manure, domestic, industrial waste and agricultural runoff. Even though nature has got its own mechanisms to take care of the wastes when they are in limited quantities. From the above Physico-chemical analysis of 12 above said parameters, the water quality parameters like total dissolve solids and calcium showed higher values than the Permissible limits of WHO standards and all other parameters agree within the Standard limits. Thus, it can be concluded that these characteristics of water are influenced by Seasonal fluctuations. It is recommended that all the water bodies need careful periodic monitoring and best water quality management practices to be strictly followed to restore their conditions into a good one, especially, in case of total dissolve solid and calcium.

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