ORIGINAL RESEARCH PAPER

Botany

COMPARATIVE PHYSICOCHEMICAL AND HEAVY METAL CONTAMINATION ANALYSIS IN LAKE WATER SAMPLES COLLECTED FROM NALLASOPARA LAKES IN PALGHAR

KEY WORDS: Palghar Lakes, Physicochemical Analysis, Heavy Metal Analysis, Cu, Fe Contamination.

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ABSTRACT

Nirmal and Chakreshwar lake are two important water bodies in Vasai-Virar Taluka, are the primary source of water for the nearby villages. The objective of the study was to analysis physicochemical parameters and simultaneously monitor the heavy metal content. During the study the physicochemical parameters like pH, temperature, Total hardness, TS, TDS and TSS were evaluated in pre and post monsoon samples at three different sites from each water body. t test and two way ANOVA test were performed to assess the variation in the pre and post analysis for any significant difference. It was observed that heavy metal content was found more in pond A (Nirmal), comparative to pond B (Chakreshwar) lake.

INTRODUCTION:

Water contamination by heavy metals is of most important concern throughout the world (Gautam *et. al.* 2014). Heavy metal pollution results in adverse effects on various parameters relating to plant quality, growth, nutrition and yield, of the microbial community (Goodarzi, 2008). Therefore, heavy metals are considered as one of the major sources of water pollution (Javed, 2013). The adverse effects of heavy metals on biological and biochemical properties are well documented (Khan et.al., 2015).

Nallasopara, a town in Palghar flourishing suburb very close to the Metropolitan city Mumbai in the western coast of Maharashtra is hub to the large population diverted from the high rising living cost of the metropolitan city. The recurring water logging in the vicinity of the area under study imposes an urge to evaluate the situation very keenly. Since this affects a larger community again and again, the deeper knowledge of the contamination and deteriorating condition of the very important buffering system consisting of the unnamed water ponds in the area come to fore. The good health of the people is essential and hence analysis of heavy metal is essential.

A keen observation superficially indicates that the current situation of the not so well-known water bodies are deteriorating which actually serve as a life saver in the situation of heavy rainfall (Mahejabeen, 2022). The easiest and the economical way to assess the water quality is the measurement of its physicochemical properties and metal contaminations.

MATERIAL AND METHODS:

Site Of Sample Collection

Nallasopara is surrounded by various hills in east and north east and planes in west and the famous hill region of Tugareshwar. Nirmal lake is about 200 m from sea coast line is a fresh water lake near Shankaracharya temple, very close to Kalamb beach about 5km from Nallasopara railway station. Nirmal lake is located at Coordinates 19.3982° N, 72.7784° E. The samples are collected at three different sites from the lake. Chakreshwar Talav is located at coordinates 19.4166° N and 72.7997° E. The samples are collected at three different sites from the lake as shown in Figure 1.

Figure: 1 Pond A locations at Nirmal Talav and Pond B locations at Chakreshwar Talav (Google Map)

Thus, for our research we have collected water from the above given places for their physicochemical analysis and detection of elements present in it. From both the water bodies three samples each were collected, which are shown in the map as site 1, 2 and 3 in red colour. The samples were collected from the above locality in containers and transported to the laboratory. Before processing samples for analysis, standard protocol was followed. The samples were assessed for the physico-chemical and heavy metal analysis of water.

Physicochemical Analysis of Water

The collected samples were analysed for different parameters like pH, temperature, Dissolved oxygen (DO), Total hardness, Total solids (TS), Total dissolved solids (TDS), Total suspended solids (TSS), Alkalinity using standard laboratory procedures. Heavy metal analysis was done on Atomic Absorption Spectrometer (AAS), (Bruhn *et.al.* 1996).

RESULTS:

Table 1 summarises the pH and temperature of pond A and B in the 3 sites as mean of three samples. ANOVA test is carried out for the pre monsoon and post monsoon samples from the same pond to check for any significant differences in the values.

Table 1: pH and temperature analysis of pre and post monsoon sample from pond A and Pond B pH acceptable for drinking water lakes 6.5-8.5 (MPCB)

pH						
Location	**Pre monsoon**	**Post Monsoon**	**D**	**D^2**	**Calculated t**	**Tabulated t**
Pond A -1	6.8	7.1	0.3	0.09	6.75	4.30
Pond A -2	6.9	7.2	0.3	0.09		
Pond A -3	7.0	7.2	0.2	0.04		
Pond B -1	6.6	7	0.4	0.16	6.00	4.30
Pond B -2	6.8	7.1	0.3	0.09		
Pond B -3	6.9	7.1	0.2	0.04		

Temperature						
Pond A -1	28.0	25.3	2.7	7.29	10.14	4.30
Pond A -2	29.4	26	3.4	11.56		
Pond A -3	27.9	25.5	2.4	5.76		
Pond B -1	28.0	26	2.0	4.0	18.6	4.30
Pond B -2	28.6	26.2	2.4	5.76		
Pond B -3	29.0	26.7	2.3	5.29		

As the calculated t value is more than the tabulated t value, we observe significant difference in pH and temperature of Pond A pre and post monsoon samples at 5% significance of difference and the same is true for Pond B also.

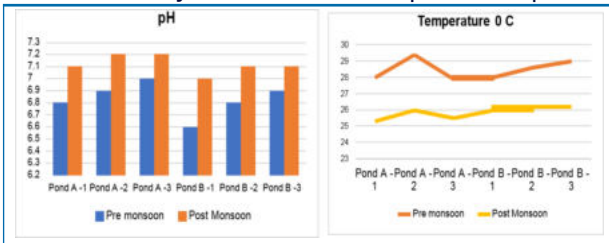


Figure 2: Graph Showing The pH & Temperature Of Pond A And Pond B In Pre And Post Monsoon Samples

Table 2: Dissolved oxygen analysis and ANOVA of pre and post monsoon sample from pond A and Pond B Dissolved Oxygen acceptable for drinking water lakes 6.5-8.5 mg/L (MPCB)

Dissolved oxygen mg/l	Pre Monsoon	Post Monsoon	D	D^2	Calculated t	Tabulated t
Pond A -1	6.11	5.11	1.0	1.0	2.4	4.30
Pond A -2	5.43	5.53	0.1	0.01		
Pond A -3	6.18	5.12	1.06	1.12		
Pond B -1	7.12	6.1	1.02	1.04	4.94	4.30
Pond B -2	6.31	5.81	0.5	0.25		
Pond B -3	7.34	6.33	1.01	1.02		

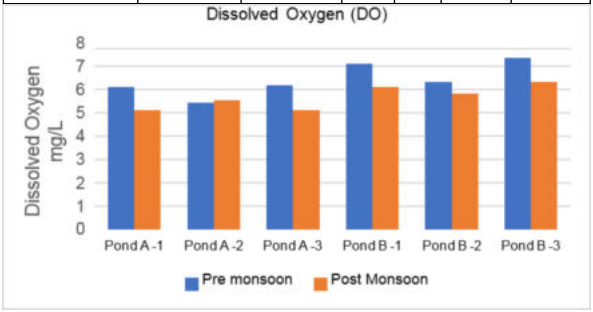


Figure 3: Graph Of Dissolved Oxygen Content In Pre And Post Monsoon Samples From Pond A And Pond B

As the calculated value is 2.4 and less than the tabulated t value of 4.30 we observe no significant difference in Dissolved Oxygen of Pond A pre and post monsoon samples at 5% significance of difference whereas the calculated value of t 4.94 is slightly above the tabulated value of 4.30, there is slight difference in DO of Pond B samples at 5% significance level.

Table 3: Total Hardness Analysis And ANOVA Of Pre And Post Monsoon Sample From Pond A And Pond B

Total Hardness mg/L	Pre Monsoon	Post Monsoon	D	D^2	Calculated t	Tabulated t
Pond A -1	84.16	90.7	6.54	42.77	4.38	4.30
Pond A -2	88.17	90.8	7.03	49.42		
Pond A -3	92.18	95.2	3.02	9.12		
Pond B -1	48.09	60.2	12.11	146.65	5.67	4.30
Pond B -2	56.11	60.2	4.09	16.72		
Pond B -3	60.12	61.8	1.68	2.82		

Total Hardness Acceptable For Drinking Water Lakes Permissible 200-600 mg/L (MPCB)

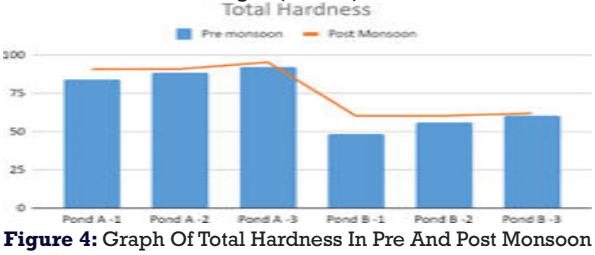


Figure 4: Graph Of Total Hardness In Pre And Post Monsoon Sample Of Pond A and Pond B

As the calculated value of t is slightly above the tabulated value there is slight difference in Total Hardness of Pond A Pre and Post monsoon samples at 5% significance level. The calculated value is more than the tabulated t value we observe significant difference in Total Hardness of Pond B pre and post monsoon samples at 5% level of significance.

Table 4: TS, TSS and TDS Analysis And ANOVA Of Pre Monsoon Sample From Pond A And Pond B

Pre monsoon	Total Solids	Total Suspended Solids	Total Dissolved Solids	D	D^2	Calculated t	Tabulated t
Pond A -1	2088.62	2088.11	0.5	1.0	1.0	2.71	4.30
Pond A -2	2049.72	2047.86	1.86	0.3	0.09		
Pond A -3	3813.24	3811.96	1.28	0.4	0.16		
Pond B -1	2404.82	2404.34	0.48	1.0	1.0	2.42	4.30
Pond B -2	2043.25	2042.06	1.19	0.9	0.81		
Pond B -3	2037.74	2032.78	4.96	1.0	1.0		

Table 5: TS, TSS And TDS Analysis And ANOVA Of Post Monsoon Sample From Pond A And Pond B

Post monsoon	Total Solids	Total Suspended Solids	Total Dissolved Solids	D	D^2	Calculated t	Tabulated t
Pond A -1	1888.32	1886.82	1.5	1.0	1.0	2.71	4.30
Pond A -2	1949.52	1947.96	1.56	0.3	0.09		
Pond A -3	3623.24	3622.36	0.88	0.4	0.16		
Pond B -1	2104.02	2102.54	1.48	1.0	1.0	2.42	4.30
Pond B -2	1843.15	1841.06	2.09	0.9	0.81		
Pond B -3	1837.13	1833.17	3.96	1.0	1.0		

TDS acceptable 500, permissible 2000 for drinking water lakes (MPCB)

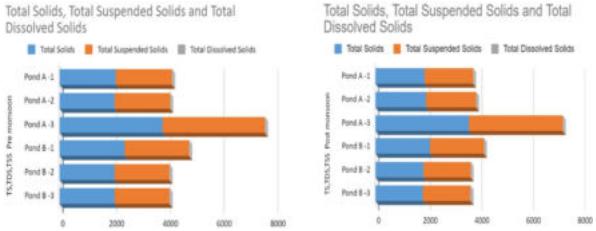


Figure 5: TS, TDS and TSS Of Pre Monsoon And Post Monsoon Samples Of Pond A And Pond B

As the calculated value is less than the tabulated t value we observe no significant difference in Total.

Dissolved Solids of Pond A pre and post monsoon samples at 5% significance of difference and the same is true for Pond B also.

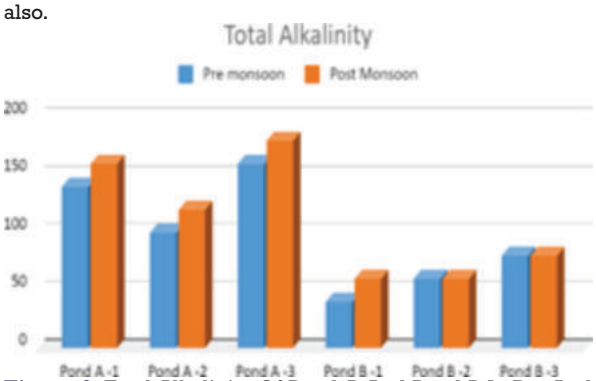


Figure 6: Total Alkalinity Of Pond A And Pond B In Pre And Post Monsoon Samples

Table 6: Total Alkalinity Of Pre And Post Samples Of Pond A And B

Total Alkalinity mg/L	Pre monsoon	Post Monsoon
Pond A -1	140	160
nd A -2	100	120
Pond A -3	160	180
Pond B -1	40	60
Pond B -2	60	60
Pond B -3	80	80

Alkalinity Acceptable For Drinking Water Lakes 200 And Permissible 600 (MPCB)

Table 7: Screening Test For Heavy Metals.

Heavy Metal Analysis	Lead	Copper	Cadmium	Zinc	Iron	Mercury
Pond A -1	x	✓	x	x	✓	x
Pond A -2	x	✓	x	x	✓	x
Pond A -3	x	✓	x	x	✓	x
Pond B -1	x	✓	x	x	✓	x
Pond B -2	x	✓	x	x	✓	x
Pond B -3	x	✓	x	x	✓	x

Cu acceptable for drinking water lakes 0.3 mg/L and permissible no relaxation (MPCB) Fe acceptable for drinking water lakes 0.5 and permissible 1.5 mg/L (MPCB)

Table 8: Quantitative Cu And Fe Analysis Of Pond A And Pond B Water Samples.

Heavy Metal Analysis	Copper (Cu) ppm	Iron (Fe) ppm
Pond A -1	1.469	0.292
Pond A -2	0.036	0.484
Pond A -3	0.036	0.238
Pond B -1	0.608	0.073
Pond B -2	0.714	0.113
Pond B -3	0.574	0.208

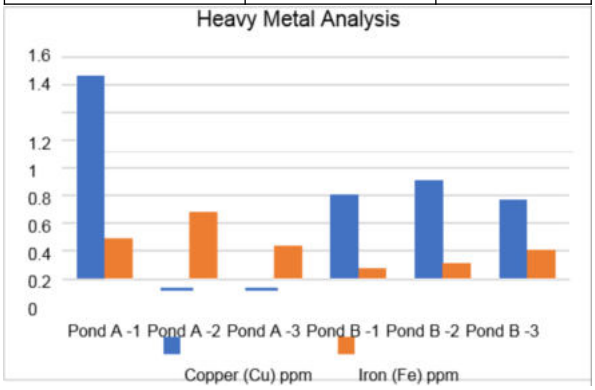
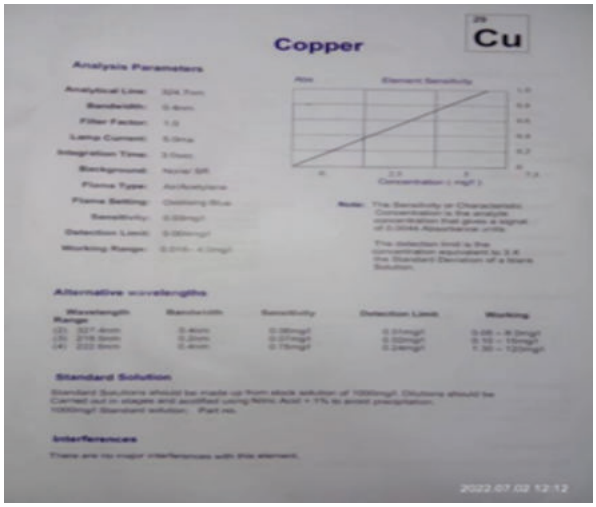


Figure 8: Graph Showing Cu And Fe Analysis Of Pond Water



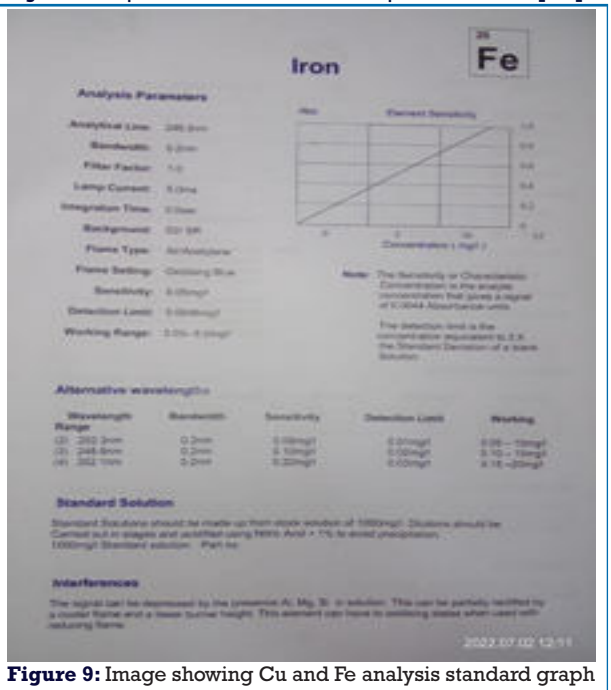


Figure 9: Image showing Cu and Fe analysis standard graph by AAS method

CONCLUSION:

The area has undergone a drastic urbanisation in the past few years after the area came under the Nallasopara (Vasai-Virar Mahanagar Palika). Due to the rapid infrastructure development and a lotmore colonisation in the vicinity, the previously undisturbed area has seen rapid disturbances leading to the neglect of the very essential water bodies in the spare land. The water analysis of Nirmal Lake by Jadhav R N (Jadhav, 2013) are comparable with our data but the hardness of the water body has increased a lot. Jadhav reported the hardness to be in range from 45 to 65 mg/l during the year which has increased to the range 84 to 92 for pre monsoon samples and 90 – 94 mg/l for post monsoon samples. It clearly indicates the hardness in this decade has increased approximately double in the period. Construction and development of community service areas has caused some changes.

The results showed the water parameters tested in the two pond water samples are very much comparable at all the three sites, and heavy metals and other parameters below permissible level, from where they were collected. Nandre has reported presence of Cu, Zn, Fe, Pb and Cr in the ground water samples at Tarapur MIDC. (Nandre, 2012). As compared to that the water parameter here are in good state as poisonous Lead (Pb) and Chromium (Cr) were absent in it. The water parameter indicates it to be within the normal range The beautification work carried out at the pond site is a good indicator of government involvement in the maintenance of these water bodies. The VVMCM corporation is actually working on the preservation and conservation of the natural water bodies in the area.

Further Research:

We plan to continue the study further in the coming projects to understand and assess the effects of the heavy metal pollution on the biodiversity of the aquatic ecosystem under study. The phytoplankton and microalgae flora could be analysed for eutrophication and can be assessed for metal bioaccumulation in these phytoplanktons.

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