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STUDIES ON PHYSICAL AND CHEMICAL QUALITIES OF LAKE WATER

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ABSTRACT

The physico-chemical parameters of water samples collected from eight sites of Varal Devi lake in Bhiwandi city, Dist Thane-Maharashtra were assessed. This lake provide drinking water in the Bhiwandi city. The physicochemical parameter like Temperature, Dissolved Oxygen (DO), Hardness (Ca^{2+}) and (Mg^{2+}), Phosphate (PO^{3-4}) were determined .The results were compared with standards prescribed by WHO (1993) and BIS (10500-1991). It was found that the water samples collected from various sites around the lake were contaminated. Phosphate, Total hardness and Magnesium hardness are above the permissible value set by WHO (1993). DO value also indicate the pollution load in the water. Magnesium hardness is also greater than the BIS value. Calcium hardness from all eight sampling sites are greater than WHO but less than maximum permissible limit set by ISI and greater than the desirable limits set by ISI. Only S4 sampling site shows higher level of total hardness than the maximum permissible limits of ISI and all S1, S2, S3, S5, S6, S7, S8 sites shows less values of hardness than maximum permissible limits of ISI. This indicates that the quality of water is very bad and it is unfit for drinking purpose.

INTRODUCTION

The resources provided by nature for well being and good health of human and even all forms of life on this planets are nothing but the water for survival purpose. Within all these natural resources created, water is one of the extremely important and essential resource for each and every lives including from one cell animal to largest blue whale. " No water, no life '' is a common aphorism depending upon the fact that water is one of the naturally occurring essential requirement of all life supporting activities (Singanan *et al*., 2008). Since it is a vibrant system, containing living as well as nonliving, organic, inorganic, soluble as well as insoluble substances. Therefore it is necessary to measure water quality which is changing day by day with respect to different sources. Alteration in the natural quality of water disturb the balance system and would become unfit for nominated uses. The availability of water through surface and groundwater resources has become critical day to day. Very less part is available on land for drinking, agriculture, domestic power generation, industrial consumption, transportation and waste disposal (Lokhande, 2011).

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Maximum number of population in India is dependent only on the surface water as a source of drinking water. Ground water are clean and free from pollutant as compared to surface water. Because of domestic, industrial, agricultural and solid waste discharge in to the water, the ground water also converted into polluted water (Godghate *et al*., 2013). The rapid growth of urban areas has further affected groundwater quality due to over exploitation of resources and improper waste disposal practices. Hence, there is always a need for and concern over the protection and management of surface water and groundwater quality (Andrew *et al*., 2005). The lakes have complex and fragile ecosystem, as they do not have self cleaning ability and therefore readily accumulate pollutants (Sindhu). The physico-chemical characteristic of water sample in various places have been estimated which is revealed from various research paper. The consequence of urbanization and industrialization leads to spoil of water.

Economy of Bhiwandi is mostly dependent on the power loom industry. Aim of the present research work is to analyse the lake water of one area of Bhiwandi and determine concentration of some pollutants in lake water. Varal Devi lake is situated near Dhamankarnaka in Bhiwandi city .The water from this lake is used for drinking purpose and people use it for bathing of domestic animal, washing of vehicles, bathing and for washing of cloths.

Table 3.1. Sampling locations in Varal Devi Lake

Sr.No.	Sample Location	Source	Sample Number
01	Varal Devi Temple	Lake	S_1
02	Near Dargah	Lake	S_2
03	Near Varal Devi Garden First gate	Lake	S_3
04	Varal Devi Garden middle portion	Lake	S_4
05	At the end of Varal Devi garden	Lake	S_5
06	Varaala Hall	Lake	S_6
07	Peace Park	Lake	S_7
08	Mansarvar- Fenagaon road	Lake	S_8

This lake water is also used for religious activity. This lake gives very beautiful scenario for tourist and for entertainment purpose. People living nearby this lake discharge their domestic waste in to the lake water and make the lake very dirty. Hence it is very essential to maintain the quality of surface water for human consumption, for the aquatic life and for other subsequent uses. Considering the above aspects of surface water contamination, the present study was undertaken to study the impact of the surface water quality of Varal Devi lake in Bhiwandi city, District Thane, state Maharashtra. In this research work, Temperature, Dissolved Oxygen (DO), Hardness (Ca^{2+}) and (Mg^{2+}), Phosphate(PO^{3-}_4) were determined during pre monsoon period(in the month of June) and result obtained is compared with the standard values prescribed by WHO and ISI.

MATERIALS AND METHODS

The present study was planned and undertaken for investigation purpose. Different eight sites were selected which are given as follows. Site S1-Varal Devi Temple, site S2- Close to Dargah situated very near to lake, site S3-Near Varal Devi Garden First gate, Site S4 - Middle portion of Varal Devi Garden, Site S5-At the end of Varal Devi garden, Site S6-Varaala Hall ,Site S7-Peace Park, Site S8- Mansarvar-Fenagaon Road sites were selected from different localities around Varal Devi lake for samples collection.

Preparation of water samples

The sample were collected from all the eight points at 07.00 am to 09.00 am in the month of June 2014 for physico-chemical examinations, standard procedure for sampling were adopted. The samples were collected in plastic canes of two liters capacity without any air bubbles. The temperatures of the samples were measured in the field itself at the time of sample collection. The samples were kept in refrigerator (Andrew *et al*., 2005). Water samples from eight sampling sites were collected during a pre monsoon period in the month of (June-2014). The sampling locations in the lake are given in following table.

Table 5.2. Physico-chemical status of water

S.No.	Parameters	WHO	ISI		Sampling Points around Varal Devi lake							
			Desirable	Maximum permissible limit	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8
01	Appearence				Unclear liquid	Unclear liquid	Unclear liquid	Unclear liquid	Unclear liquid	Unclear liquid	Unclear liquid	Unclear liquid
02	Colour	Not mentioned			Very light brown	Very light brown	Very light brown with reddish tinge	Brown with reddish tinge	Brown with reddish tinge	Yellow with reddish tinge	Yellowish brown	Yellowish brown
03	Odour	——	Unobjectionable	—	Foul odour (irritant to nasal way on smelling)	Wet soil odour	Foul odour	Foul odour (irritant to nasal way on smelling)	Light Foul odour (irritant to nasal way on smelling)	Foul odour	Foul odour (irritant to nasal way on smelling)	Urine like odour (irritant to nasal way on smelling)
04	Taste	____	Agreeable	__	Sour	Sour	Sour	Sour	Sour	Sour	Sour	Sour
05	Temperature	____	___	___	32^0C	32.5^0C	32.5^0C	32^0C	31.5^0C	33^0C	32.2^0C	31^0C
06	Phosphate in ppm	5.0ppm	----	-----	13.25±0.0441	12.50±0.5	13.25±0.041	11.5±0.5	14.5±0.5	14.25±0.75	14.5±.5	20.5±0.5
07	DO in ppm	2.0-6.0	-----	2.0-6.0	5.297±0.152	5.913±0.369	6.282±0.368	8.625±0.217	5.543±0.368	7.022±0.3.7	6.652±0.368	8.502±0.372
08	Total Hardness in ppm	100.0ppm	300ppm	600ppm	416.5±14.7	441.98±0.989	485.1±14.727	631.12±3.919	478.24	419.44	439.04	470.4
09	Calcium in ppm	75.0	75.0	200ppm	129.48±3.797	110.252	60.488±2.356	137.471±3.930	136.68	128.83	113.121	54.9897
10	Magnesium in ppm	30.0	30.0	100.0	287.0145±10.905	316.25	424.610±12.34	493.645±7.847	341.56	290.60	325.91	415.410

Physico-chemical analysis

Analysis were carried out for various water quality parameters such as, Temperature, Dissolved Oxygen (DO), Hardness (Ca^{2+}) and (Mg^{2+}), Phosphate(PO^{3-}_4). All the reagents used for the analysis were AR grade and double distilled water was used for preparation of solutions (Andrew *et al*., 2005; Vogel's *et al*).

RESULTS AND DISCUSSION

Colour

Colour in surface and ground water results primarily from the presence of natural organic matter particularly aquatic humic matter. Humic matter consists of humic and fulvic acid ; both cause a yellow – brown colour. Humic acid give a more intense colour, and the presence of iron intensifies the colour through the formation of soluble ferric humates. Suspended particles, especially colloidal–size particles such as clays, algae, iron and manganese oxides give waters an appearance of colour; they should be removed before the measurement. Industrial waste water contain lignin , tannins, dyes and other organic and inorganic precursors in the formation of disinfection by-products.

Colour also is removed to make chemicals that cause colour. Humic materials and the colour caused by these materials are removed from potable water supplies for aesthetic reasons and for health reason because they are water soluble for industrial applications. Coloured industrial waste waters may require colour removal before discharge in to watercourses (Andrew *et al*., 2005; Sindhu). The colour value of water is extremely pH-depended and invariably increases as the pH of water is raised. When reporting a colour value, specify the pH at which the colour is determined. Colour is determined by visual comparison of the sample with transparent double distilled water.

Temperature (T)

Temperature is an important biologically significant factor, which plays an important role in the metabolic activities of the organism. The temperature was ranging from 31.0°C to 33.0°C during the study period.

Odour

Odour, like taste depends upon contact of a stimulating substance with the appropriate human receptor cell. The stimuli are chemical in nature and the term "chemical senses" often is applied to odour and taste. Water is a neutral medium, always present on or at the receptors that perceive sensory response. In its pure form water is odour free. Man and other animal can avoid many potentially toxic food and water because of adverse sensory response. These senses often provide the first warning of potential hazard in the environment (Andrew *et al*., 2005). Odour is recognized as quality factor affecting acceptability of drinking water (and food prepared with it). Odour is determined by sensory response of nose (Andrew *et al*., 2005).

Taste

Taste refers to only gustatory sensation called bitter, salty, sour and sweet that result from chemical stimulation of sensory nerve ending located in papillae of tongue and soft palate. Flavour refers to a complex of gustatory olfactory and sensation resulting from chemical stimulation of sensory nerve ending located in the tongue, nasal cavity and oral cavity. Water sample taken in to mouth for sensory analysis always produce a flavor, although taste, odour or mouth feel may predominate depending upon the chemical substances present (Andrew *et al*., 2005).

Dissolved Oxygen (DO) in ppm

Dissolved oxygen is important parameter in water quality assessment and reflects the physical and biological processes prevailing in the water. The DO values indicate the degree of pollution in water bodies. DO value ranges from 5.2ppm to 8.6ppm.The site S3,S4,S6,S7 and S8 show the value of DO above the permissible limit set by WHO (above 6.0ppm) which indicates the pollution load in water.

Total hardness (TH) in mg/l

Hardness is the property of water which prevents the lather formation with soap . Hardness of water mainly depends upon the amount of calcium or magnesium salts or both. The values of hardness are all above the standard limit set by WHO and desirable limit prescribed by ISI. But few site shows the hardness values less than the maximum permissible limit set by ISI.S4 shows the higher value of hardness than maximium permissible limit set by ISI and rest of all site shows less value than this standard.

Calcium (Ca2+) in ppm

Calcium is directly related to hardness. Calcium hardness of all water sample from all site are greater than standard values prescribed by WHO .Only site S3 has the lower value than WHO

Magnesium (Mg2+) in ppm

Magnesium are directly related to hardness.Magnesium hardness of all water sample are above the standard lmit set by WHO and ISI

Phosphate (PO_4^{3-}) in ppm

Phosphate may occur in surface water as a result of domestic sewage, detergents, and agricultural effluents with fertilizers. Amount of phosphate in all water sample from all the eight sites are greater than the standard values set by WHO and ISI. All the data can be summarized in Table 5.2.

Conclusion

Deviations were observed by water samples at different points in viral Devi Lake. All the water samples from sites S1 to S8 shows very poor water quality. It was probably due to the domestic waste in lake water.

The water samples from sites S1 to S8 are polluted and unfit for drinking purpose. To improve the quality of water of the entire eight sites, there should be continuous monitoring of the pollution level.

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