

# Water Quality Assessment of Lakes in Vashi, Navi Mumbai, Maharashtra, India

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**Abstract:** *The paper reveals the water quality of two major lakes in Vashi region. These lakes are excessively used for various anthropogenic activities like bathing and washing. The physiochemical quality analysis of lake water gives an idea about the health of the lake. This kind of monitoring cautions us of any degradation in the lake ecosystem that can result from the impacts of anthropogenic activities. The quality assessment of the lake makes us conscious of the lake degradation so that the corrective measures can be taken well before the impacts become irremediable. The paper concentrates on sampling and analysis of Lakes in Vashi. Seasonal analysis physical and chemical parameters of Vashi Gaon Lake and Juhu Gaon Lake were done for two consecutive years (2011-12 & 2012-13) and the results were concluded. The results revealed that there were significant seasonal variations in some physiochemical parameters and that most of the parameters exceeded the CPCB limits for surface waters. It also shows a year wise increase in the values of parameters thus indicating that the lakes require treatment. Further, remedial measures are also suggested for the restoration and conservation of the lakes.*

**Keywords:** Lake Water Quality, Vashi, CPCB, anthropogenic

## 1. Introduction

A lake is a body of relatively still water of considerable size, localized in a basin that is surrounded by land apart from a river, stream, or other form of moving water that serves to feed or drain the lake. Lakes are inland and not part of ocean and are distinct from lagoons. Lakes are larger and deeper than ponds. Lakes are the best available fresh water source on the earth surface. Out of the total amount of water present on the Earth's surface only 0.007% of fresh water is present in the lakes which is accessible. Lakes are used for domestic and irrigation purposes, and provide ecosystems for aquatic life especially fish, thereby functioning as a source of essential protein, and for significant elements of the world's biological diversity. They have important social and economic benefits as a result of tourism and recreation, and are culturally and aesthetically important for people throughout the world [1]. The quality of lake water affects the aquaculture activities, the fish productivity levels and the species composition of avifauna. Lakes are very precious water resources but are equally vulnerable to pollution due to its easy accessibility for various anthropogenic requirements. This paper gives a comparative analysis of water quality of lakes in Vashi by analyzing various physiochemical parameters and considering the activities that takes place or used to take place in the Lakes. Based on the results, an attempt is made to summarize the significance, present status and strategies to be undertaken for the improvement of the water quality and hence overall health of the lakes.

## 2. Study Area

The study was carried for two lakes in the prime locality of Navi Mumbai, Maharashtra, namely Vashi. The detailed Geographical location, names, and total area of the Lakes are as mentioned below:

**Table 1:** Study Area

No.	Lake	Latitude	Longitude	Area
1	Vashi Gaon Lake (Vashi)	19° 4' 13" N	72° 59' 48" E	1500 sq.m
2	Juhu Gaon Lake (Vashi)	19° 5' 8" N	72° 0' 3" E	500 sq.m

- **Vashi Gaon Lake** – This Lake has a Shiva temple in its vicinity. The lake is used for domestic activities like cleaning and washing. The offerings in the temple are also immersed in the lake.
- **Juhu Gaon Lake** – The Lake during the study period was closed for the public use as it appeared highly eutrophied owing to the various domestic activities carried out over there earlier.

## 3. Methodology

Two consecutive years seasonal sampling from the two lakes of Vashi was done using grab sampling technique. The samples were analyzed in the laboratory using the standard procedures from APHA[2] and the values were compared with the standards given by CPCB. The parameters considered for the study are pH, Dissolved Oxygen, Total Dissolved Solids, Chloride Content, Phosphate, Total Alkalinity and Total Hardness. The Dissolved Oxygen of the samples was fixed on site. All the parameters were analyzed for the pre-monsoon, monsoon and post-monsoon period of the years 2011-12 and 2012-13. The samples were collected in the clean 5 liter polyethylene cans.

## 4. Result and Discussion

### 4.1 pH

The pH value of both Vashi Gaon lake and Juhu Gaon lake was found to be more in 2013 than in the year 2012. The pH was found to be in alkaline range with maximum pH of 8.69 in the post monsoon season of 2013. When pH value falls

below 6.15 or rises above 8.5, many of the basic nutrients become died up, so that they are unavailable to plants and the overall productivity is lowered [3]. If seasonal variation is observed, it can be seen that the samples show high pH value in the post monsoon season and lowest in the monsoon season. The high pH value also indicates more amount of salts present which can lead to decrease in the productivity level of an ecosystem

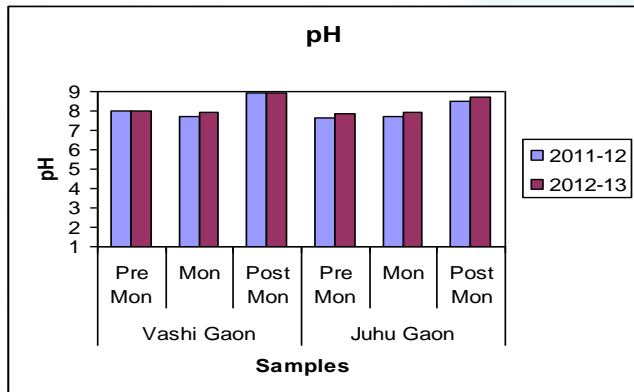


Figure 1: Graph of pH

#### 4.2 Dissolved Oxygen

Dissolved Oxygen content of water bodies depends upon various physical, chemical and biological activities of that aquatic ecosystem. The DO content of both the lakes is below 6 mg/lit, further decrease in DO might make it difficult for the aquatic ecosystem to survive, due to low availability of oxygen. The DO values of Vashi Gaon Lake ranged between 3.04 mg/lit to 5.4 mg/lit while that of Juhu Gaon Lake ranged between 3.2 mg/lit and 4.7 mg/lit which is very low. Concentration below 5 mg/lit may adversely affect the functioning and survival of biological communities and below 2 mg/lit may lead to fish mortality [4]. This can lead to overall decrease in the primary productivity of the lake. In the seasonal analysis the dissolved oxygen was found to be maximum in monsoon season which may be due to dilution of lake water and may be due to diffusion of atmospheric oxygen into water.

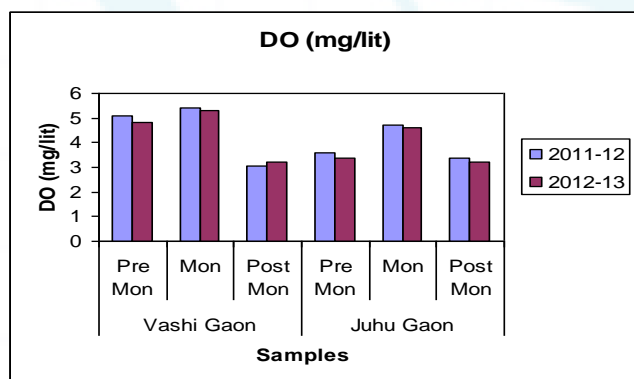


Figure 2: Graph of Dissolved Oxygen

#### 4.3 Total Hardness

Waters of Vashi Gaon Lake was found to be very hard in both the years. All the values were found to exceed the permissible limits prescribed by CPCB. Addition of sewage,

detergents and large scale human use might be the cause of elevation of hardness. The hard water generally requires more amount of soap to foam formation which might have significant economical and ecological impact as most of the lake water is used for washing and bathing. The high amount of hydroxyl ions can lead to problems of algal bloom which is observed at location[5]. The Juhu Gaon lake on the other hand had all their values well below the permissible limits. This could be because the lake was closed for public use since a year prior to the study. In the seasonal analysis, it was observed that the hardness was highest in the post monsoon sample while lowest during monsoon. Higher values of hardness during post monsoon can be attributed to low water level and high rate of evaporation of water while lowest value during monsoon can be due to dilution of water by rain.

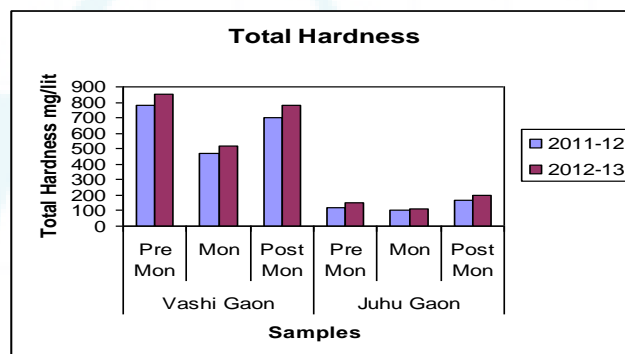


Figure 3: Graph of Total Hardness

#### 4.4 Total Dissolved Solids

The amount of dissolved solids present in water determines its suitability for domestic use. The recommended limit for the total dissolved solids present in water is 500 mg/lit. These samples may be treated good for domestic use [5]. The Total Dissolved Solids (TDS) of both the Lakes during both the years was found to be enormously high and exceeding the standards, which may be due to presence of carbonates, bicarbonates, chlorides, phosphates, calcium, magnesium, etc. in abundance. The high content of dissolved solid increases the density, turbidity, hardness, salinity, etc and also decreases the solubility of oxygen in water. High TDS also reduces the light penetration and thus affecting photosynthetic activity and primary productivity of Lakes. This might have further reduced the dissolved oxygen content of Lakes suppressing the aquatic flora and fauna. It also affects the gills of fish and thus, resulting in various respiratory problem which prove to be fatal.

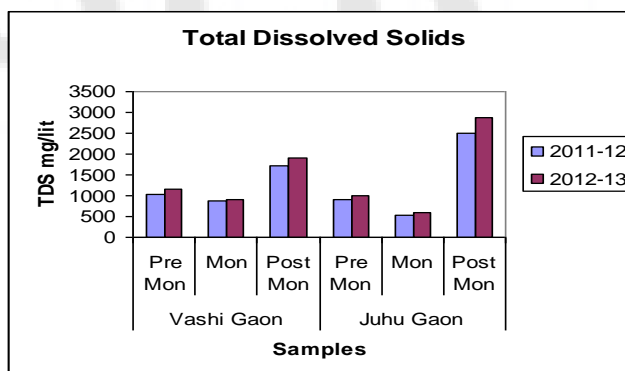


Figure 4: Graph of Total Dissolved Solids

4.5 Chlorides

Chloride occurs in all types of natural waters. The chloride content of both the lakes during both the years of study was found to be within CPCB permissible limit, although slight seasonal variation was observed. Highest value was observed during the post monsoon period which may be due to low water level and more evaporation of water, while lowest value was observed during monsoon which can be attributed to the dilution of water due to rains. Chloride increases proportionately with pollution. These are less important pollutants taking very less part in various interactions in the system. The quantity of these ions is affected by pH, temperature, presence of organic matter, other ions and dilution factor [2].

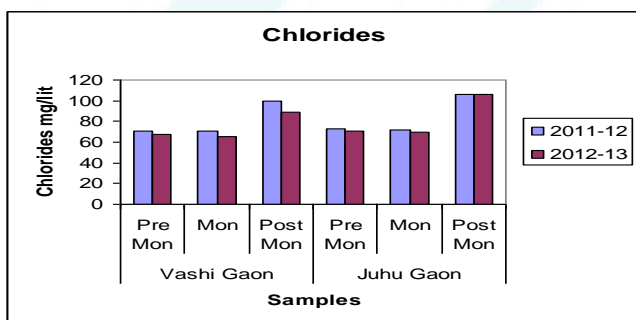


Figure 5: Graph of Chlorides

4.6 Phosphate

Phosphate content in the Vashi Gaon Lake in the pre monsoon season was under the permissible limits while the monsoon and post monsoon values exceeded the permissible limits given by the CPCB. The phosphate content of the Juhu Gaon Lake exceeded during both the years in the samples of all the seasons. Significant amount phosphates will lead to increase in the nutrient content of the lake and finally the lake will become eutrophic. Phosphates themselves are not toxic. Their high content in the river and lake water causes excessive growth of algae. Algae on the surface of the water avoid contact with atmospheric oxygen and substantially interfere with the biological processes in the water. Water contains less dissolved oxygen and becomes unsuitable for the organisms living in it. Eutrophication of water slows down the self-cleaning process, causing the half-life contaminants in waterways extending [6].

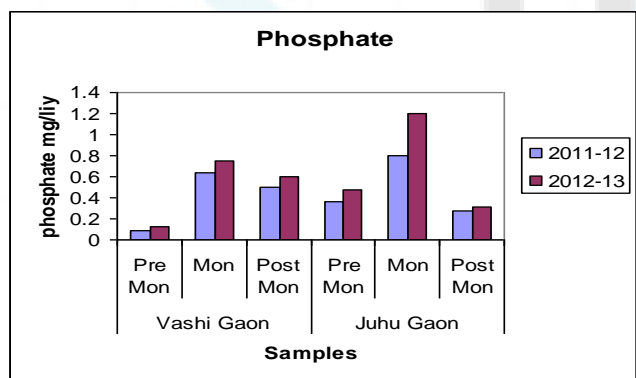


Figure 6: Graph of Phosphate

4.7 Total Alkalinity

Total Alkalinity is the measure of the substances in the water that have “acid-neutralizing” ability. Alkalinity value less than 100 mg/lit is desirable for domestic use [3]. The alkalinity of both the lakes during both the years of the study was found to be very high and exceeding the permissible limits of CPCB. The high amount of hydroxyl ions can lead to problems of algal bloom [4] which is observed in both the lakes. Higher values of alkalinity in both the lakes were registered during summer in the post monsoon samples. This might be due to the presence of excess of free CO<sub>2</sub> product as a result of decomposition process coupled with the mixing of sewage and domestic waste. The low alkalinity during rainy season may be due to dilution from rain water[3].

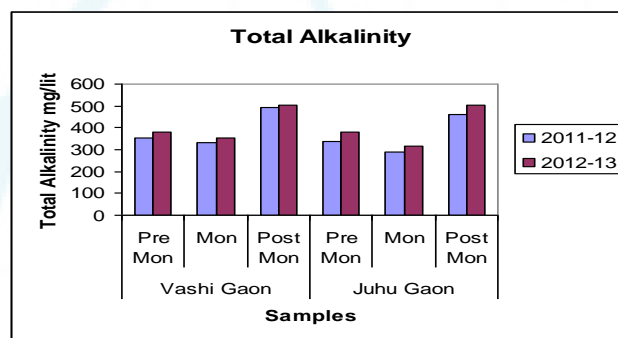


Figure 7: Graph of Total Alkalinity

5. Conclusion

This study reveals the quality of the lakes in Vashi region. The results of Vashi Gaon Lake indicates that all the parameters except chlorides and phosphate in the pre monsoon season exceed the permissible limits given by CPCB while in case of Juhu Gaon Lake, except chlorides and total hardness, all the other parameters exceed the permissible limits given by CPCB. pH in both the lakes is in the alkaline range.

Seasonal analysis shows that most of the parameters have increased in the summer season due to higher evaporation rates while reduced during monsoon which could be due to dilution by rainfall. The high values of almost all parameters indicate that the water bodies are highly polluted and treatment of the water needs to be done in order restore back its water quality, ecosystem and aesthetic beauty. Dredging out of solids, bioremediation and phytoremediation techniques can be implied for the treatment of the water. Further after treatment, strict measures also need to be taken to avoid further deterioration of the water quality. Fencing of lake, human activities like washing, bathing immersion of idol during festivals, dumping of other materials like flowers, oil, leaves, etc. need to be strictly prohibited. A strong attempt to make the nearby people aware about the lake environment and its importance has to be done because they are one of the major stakeholders associated with the environment

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## Author Profile



**Pooja Desai** has received her B.Sc. degree in Microbiology and M.Sc. degree in Environmental Science from University of Mumbai, Mumbai, Maharashtra, India in 2004 and 2006 respectively.

After her post graduation she worked on various assignments in the field of environment. She now works with SIES (Nerul) College of Arts, Science & Commerce as Assistant Professor for M.Sc. Environmental Science course since 2009. Her field of interest includes Wastewater Treatment Environmental Biotechnology and Organic Farming.

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