**International Journal of Multidisciplinary Research and Development**
**www.allsubjectjournal.com**
**ISSN Online: 2349-4182 ISSN Print: 2349-5979**
**Received: 28-11-2023, Accepted: 13-12-2023, Published: 29-12-2023**
**Volume 10, Issue 12, 2023, Page No. 67-70**

# A study on water quality assessment of Dahisar River from Mumbai, Maharashtra

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**Abstract**
Dahisar river is one of the important River of Western Suburban of Mumbai in Dahisar with total catchment area of 3488 Hectares with annual rainfall 1685mm. Fields observations indicated that the river also suffered from dumping of Debris from construction activities, industrial wastes on the banks and disposal of other waste matter. Ingress encroachments on the bank as well as modification of River course and local diversion of streams have compounded by the risk of flooding. The path of Dahisar River has narrowed due to large number of human Settlements throwing waste matter in river. In this study, we have evaluated the water quality of Dahisar River at different localities in Mumbai. The present study evaluates the pollution status and its impact on the biological, chemical and physical Parameters of the soil, water and meiofauna of the Dahisar river. This research will help to draw the attention of environmental concerned bodies which will help to regain the fresh condition of the Dahisar river and will improve the health status of the locals near the Dahisar River, Dahisar, Mumbai.

**Keywords:** Dahisar, River, Pollution, Mumbai, Maharashtra

## Introduction

Water plays an important role in the world economy. Approximately 70% of the freshwater used by humans goes to agriculture. Fishing in salt and fresh water bodies is a major source of food for many parts of the world. Much of long-distance trade of commodities and manufactured products is transported by boats through seas, rivers, lakes, and canals. Large quantities of water, ice, and steam are used for cooling and heating, in industry and homes. But the degradation in the quality of water has begun to raise a major concern in most parts of the World, one of which is also the Dahisar River which is located in metropolitan city of Mumbai in Maharashtra.

Rapid population growths, land development along river basin, urbanization and industrialization have subjected the rivers to increase stress, giving rise to water pollution and environmental Deterioration. The surface water Pollution issue has been enlisted as one of the most serious problems in developing countries. Most of the rivers in the urban areas of the developing world are the end point of effluents discharged from the industries. In India, urban runoff and sewerage disposal in river catchments areas is the major problem of river water quality maintenance. The wastewater from urban runoff and industrial discharges contributes to water resources degradations, reduces agriculture production and affects public health. According to Kaushik *et al*. (2009), in India, where most of the developmental activities are still dependent upon rivers for cleaning as well as disposal purposes, it becomes very important to systemically study the status of pollution of the rivers in relation to various anthropogenic activities, since river water has been used as drinking water and irrigation water for agriculture and for fish culture throughout the history of mankind. Also, they are important in soil fertility maintenance, transportation, forest resources development and wildlife conservations. Therefore, comprehensive river water quality monitoring program is becoming a necessity in order to safeguard public health and to protect the valuable and vulnerable freshwater resources.

Studies on the water quality were carried out by various researchers on various effluents. These studies revealed that anthropogenic activities strongly affect the Water quality. This was a result of cumulative effects not only from upstream development but also from inadequate Wastewater treatment facilities. The water quality can Be measured by analyzing the variations of total suspended Solids, total phosphorous, chemical oxygen demand (COD), copper, iron, nickel, nitrogen, lead, zinc, and so on. The physico-chemical parameters like Temperature, Turbidity, pH, Electrical conductivity, Total solids (TS), Dissolved Oxygen, Free $CO_2$, Total hardness, Calcium, Alkalinity, Chloride, Nitrate, Phosphate, Iron, Sulfates, Biochemical oxygen demand (BOD) Chemical Oxygen Demand (COD) and Manganese are measured.

Heavy metals are considered very important and highly toxic pollutants in the various environmental departments. Eco toxicologists and environmental scientists use the term “heavy metals” to refer to metals that have caused environmental problems. Heavy metals including both essential and non-essential elements have a particular significance in Ecotoxicology, since they are highly persistent and all have the potential to be toxic to living organisms. The metals which have been studied extensively the last decades are: Cd, Hg, Zn, Cu, Ni, Cr, Pb, Co, V, Fe, Mn, Ag and Sn. Some Metals that have received more attention which are Hg, Cd, and Pb, because of their highly toxic properties and their effects on the environment, water and the living organisms.

## Material and Methods

In the present study the water quality of Dahisar River at different localities in Mumbai, Maharashtra was evaluated. Samples were collected from the main streamline of Dahisar River and its branch. The present study undertaken to assess the concentration of physio- chemical parameters and pollutants in water. Sanjay Gandhi national park is a protected area in Borivali, Mumbai in state of Maharashtra. It occupies 87 $km^2$ area. Dahisar river flows roughly North west through Sanjay Gandhi National Park, Sri Krishna Nagar, Daulat Nagar, Leprosy Colony, Kandar Pada, Sanjay Nagar and Dahisar Gaothan before meeting Arabian sea via Manori Creek occupying length of 12 kms. Its basin size is 34.88 km Upper stream of boating area where water flows from Tulsi lake in Sanjay Gandhi National Park was selected for the present investigation because this park has very Rich biodiversity at this place.

## Study site

During our investigation four sampling sites at approximately equal distance of 4 km were selected. First site at Sanjay Gandhi National Park, Second site at Borivali station, Third site at Dahisar Bridge and Fourth site at Manori creek were selected for collection of water sample from Dahisar river. Water samples were collected using a clean plastic bucket, transferred to clean plastic Bottles and transported to the laboratory and stored.

**Sanjay Gandhi National Park:** Upper Stream of Boating area at Sanjay Gandhi National Park of Dahisar river was selected for the present investigation because this park has very rich biodiversity at this place. The texture of the sediment is loamy and has slight silt. It has small hilltops and the place is richly surrounded by the various types of trees.

**Borivali station:** Borivali station is surrounded by slum area around railway track. Waste products and faecal matter are disposed.

**Dahisar Bridge:** Dahisar Bridge is selected as it is surrounded by residential area with high population throwing the waste matter in river.

**Manori creek:** Manori creek runs along the northern Mumbai, India. Dahisar river drains into this creek. Manori is surrounded by mangroves. Texture of soil is muddy and clayish. Fishing and farming are the major occupations among the locals.

## Result and Discussion

The following physico-chemicals parameters were observed after the analysis of water samples which were collected from Dahisar river from different locations.

**Table 1**

| Test | Sanjay Gandhi national park | Borivali station | Dahisar bridge | Manori creek |
|---|---|---|---|---|
| Ph | 7.3 | 6.3 | 6.6 | 7.9 |
| BOD | 4.2 mg/L | 26.2 mg/L | 16.1 mg/L | 2.7 mg/L |
| COD | 12.5 mg/L | 53.7 mg/L | 48.5 mg/L | 8.93 mg/L |
| Total Hardness | 190 mg/L | 298 mg/L | 283 mg/L | 2160 mg/L |
| Alkalinity | 160-170 mg/L | 600 mg/L | 700 mg/L | 200-210 mg/L |
| Chloride | 285 mg/L | 7263 mg/L | 11055mg/L | 16615 mg/L |
| Turbidity | Low | High | High | Low |
| Phosphate | 0.875 mg/L | 8.312 mg/L | 9.752 mg/L | 1.9 mg/l |
| TDS | 190 mg/L | 530 mg/L | 480 mg/L | 850 mg/L |
| TSS | 80 mg/L | 380 mg/L | 210 mg/L | 130 mg/l |
| Chromium | -- | >0.05 mg/L | | -- |
| Lead | -- | 2.07 mg/L | 0.14 mg/L | -- |

## pH

pH recorded at Sanjay Gandhi National Park was 7.3, Borivali station was 6.3, Dahisar Bridge was 6.6 and Manori creek was 7.9. Water samples were more acidic at Dahisar Bridge and Borivali station. pH of Manori creek water sample showed higher pH values than the other sampling sites. Whereas pH value of Sanjay Gandhi National Park was almost neutral. However, all the values of pH were within the permissible limits of (6.5 to 8.5) prescribed by ISI. A slightly alkaline pH is preferable in waters as heavy metals are removed by carbonate or bi-carbonate precipitation.

## Biological Oxygen Demand (BOD)

It represents the demand of oxygen required by aerobic organisms in water. The presence of organic matter in water increases the biochemical oxygen demand. In Unpolluted waters/rivers, the BOD is usually 5 mg/L or lower. Higher value of BOD results in the Depletion of D.O. This reduces the availability of oxygen for living organisms, like fish, Plants etc. and leads to stress on aquatic plants, animals and ultimately death. River water having BOD values more Than 10 mg/L is considered as moderately polluted and when the level is more than 20 mg/L it is said to be highly polluted. It has been observed that BOD values are higher in polluted Waters and lower in pollution free waters. The average concentration levels at each of the four sampling points Sanjay Gandhi National Park, Borivali station, Dahisar Bridge and Manori creek were 4.2, 26.6, 16.8 and 2.7 respectively (all concentration levels in mg/L). On the comparison of the BOD values, it was observed that BOD values were higher in Borivali station and Dahisar Bridge as compared to Sanjay Gandhi National Park and Manori creek. This may be due to lower water levels and saturation of impurities. Higher values of BOD at the 2 sampling locations, as against prescribed levels, indicate that there is significant organic pollution. Also the BOD values were observed to be substantially higher than the prescribed levels.

**Chemical Oxygen Demand (COD)**

Presence of organic matter and chemical compounds in water Demands oxygen for oxidization process. COD is a measure of organic pollution of water. It measures indirectly the presence of organic matter in water. Higher values of COD indicate that there is high Organic pollution leading to a depletion of dissolved oxygen COD is an indicator of organic pollution in Surface water. This is a danger to aquatic ecosystem. The average concentration levels at each of the Four sampling points Sanjay Gandhi National Park, Borivali station, Dahisar Bridge, Manori creek were 12.5, 53.7 48.5, 8.93 (all concentration levels in mg/L). The variation in the values of COD at all points were observed. Lower values of COD at Manori creek, compared to others site, were observed. This is due to dilution of Water in the sea water. Comparing the COD values at all the stations (average per season) with the permissible Limits (10 mg/L) indicates the high organic pollution at Borivali station and Dahisar Bridge. The both sampling stations Borivali station and Dahisar Bridge are surrounded by industrial units and dense population of slums which discharge sewage, and industrial effluents increasing pollution to a very vulnerable state. Higher COD values may be due to concentration of water as a result of evaporation etc.

**Total Hardness**

Hardness of water is an important parameter for indicating the suitability for Industrial and domestic purposes. Hardness causing cat ions are $Ca^{2+}$ $Mg^{2+}$, $Sr^{2+}$, $Fe^{2}$, $Mn^{2+}$. Hardness is also caused by anions $OH^{-}$, $CO^{2-}$ and $HCO^{-2}$. If the total hardness exceeds 150 mg/L the water is not suitable for fish. The average concentration levels at each of the four sampling points Sanjay Gandhi National Park, Borivali station, Dahisar Bridge, Manori creek the values were, 190, 298, 283 & 2160 (all concentration Levels in mg/L). During the present study, it was observed that at all the four locations, Sanjay Gandhi National Park, Borivali station, Dahisar Bridge, Manori creek, water is hard and not suitable for any domestic or industrial use. At Manori creek, the values of total hardness obtained were significantly higher as compared to other sites. This may be due to the effect of sea water.

**Alkalinity**

Alkalinity of water is measured in terms of Carbonate, Bicarbonate and hydroxide alkalinity. Total Alkalinity includes all types of Alkalinity. In Sanjay Gandhi National Park alkalinity value observed was 160– 170 mg/L. in the water sample. In Manori creek alkalinity value is 200 – 210 mg/L. At both Borivali Station and Dahisar Bridge alkalinity value observed was too high 600 – 700 mg/L as compared to Sanjay Gandhi National Park and Manori creek. Due to anthropogenic impact alkalinity level of water in Dahisar Bridge and Borivali station is very high from normal value. Whereas due to less interference of human, alkalinity level of water in Sanjay Gandhi National Park is within the normal range. In Manori creek alkalinity level of water is moderate.

**Chlorides**

Chlorides are usually present in water. They are also added in domestic water supply as bleaching Agent, to kill micro-organisms. Presence of chlorides in water, above the permissible limit (higher Concentration) is an indicator of pollution. The high concentration of chlorides may be due to organic Wastes or industrial effluents. They are very harmful to aquatic life. The permissible limit of chlorides in Water is (250 mg/L). The average concentration levels at each of the four sampling points Sanjay Gandhi National Park, Borivali station, Dahisar Bridge, Manori creek were 285, 7263, 11055 & 16615 (All concentration levels in mg/L). The present study indicates that the chloride concentration is substantially higher at all the four Sampling points as compared to the permissible limits (250 mg/L), it was also observed that the chloride concentration was higher at Manori creek than at other sampling points. This is due to the effect of sea water.

**Turbidity**

Turbidity observed in water samples from Sanjay Gandhi National Park and Manori creek were low. Whereas Borivali station and Dahisar Bridge turbidity level was high. Turbidity in water is primarily due to presence of suspended particles like waste disposal, Chemical and soil.

**Total Dissolved Solids**

Total dissolved solid level observed at Borivali station and Manori creek were 530 mg/L and 850 mg/L respectively. High value recorded at Borivali station site may be due to the discharge of certain chemical waste. At Manori creek total dissolved solids were high. The higher values of TDS at Manori creek can be attributed to the large number of solids that are found dissolved in sea waters, the common ones are carbonates, bicarbonates, chlorides, sulphates, phosphates and nitrates of calcium, magnesium, sodium, potassium, iron, etc.

**Total suspended solids**

High TSS values were observed at Borivali station and Dahisar Bridge. The total suspended solids level varied between 200 to 300 mg/L. This may be due to discharge from industries and slums near the Borivali station. The TSS determination is extremely valuable in the analysis of polluted water.

**Phosphate**

Increase in concentration of phosphate indicates that there is mixing of industrial effluents, sewage Water and waste water in the river water. Higher concentration of Phosphates leads to eutrophication. The average concentration levels at each of the four sampling points Sanjay Gandhi National Park, Borivali station, Dahisar Bridge, Manori creek were 0.875, 8.312, 9.752, 1.9 (all Concentration levels in mg/L). In the present study, the location wise analysis indicated that the phosphate concentration at Borivali station and Dahisar Bridge was higher than the other sampling points. Near Dahisar Bridge eutrophication in the water sample was also observed, which indicates that the Phosphate content in water varies with local factors at the sampling point.

**Heavy metal analysis**

In the qualitative analysis test chromium and lead are detected in the sample of Borivali and Dahisar Bridge. After the confirmation of chromium and lead both samples transferred to the C era laboratory, Kurla, Mumbai for the further evaluation.

**Chromium**

Chromium is used in pigments for paints, cement, paper, rubber etc. They are also used in metal alloys. A long-term exposure to chromium can cause damage to lungs and intestinal tract. Besides the lungs and intestinal Tract, the liver and kidney are often target organs for chromate toxicity. It also has the potential to have negative effects on the circulatory and nerves tissues. It is known to have visible effects through Bioaccumulation thus causing the danger of eating fish which must have been exposed to high levels of Chromium. Concentration of Chromium in excess of 0.32 mg/l in water can inhibit growth of algae. The permissible limit given by CPCB is 2.0 mg/L for total Chromium. In the both samples (Borivali and Dahisar Bridge) chromium is present below the 0.05 ppm which are not detected exactly therefore show 0.0 ppm concentration.

**Lead**

Concentration of lead in natural waters is increased mainly through anthropogenic activities. A large number of industries like battery manufacturers, petroleum, paints, ceramics, electric cable insulation, pesticides and plastics use lead in the various operations. Waste water from these industries contains varying quantities of lead and that contaminates water resources.

The toxicity of lead is acute in children and infants than Adults. In mild cases of lead poisoning leads to insomnia, restlessness, loss of appetite and some gastro- intestinal problems which are common symptoms. Its exposure has negative effects on neuropsychological developments in children. The Permissible limit for lead suggested by CPCB is 0.1. The concentration of lead in the water sample from Borivali station was 2.07 mg/L which was high and 0.14 mg/L from Dahisar Bridge.

**Conclusion**

It is revealed from the results that the concentration levels for several physiochemical parameters have exceeded the maximum permissible limits. It can therefore be concluded that the water samples from the Dahisar river are substantially polluted due to various pollutants. Therefore, the water cannot be used for any domestic or industrial purposes. Several adverse effects are possible by the polluted water of the river on the health & hygiene of the people staying in adjoining areas near the river. It is also ecologically damaging the aquatic life of the river and the Arabian Sea besides it also going to affect the mangrove Ecosystem. Therefore a mechanism for continuous monitoring of the quality of the water of Dahisar river is required. Also concentrated efforts are required from all concerned authorities to reduce dumping of industrial and residential wastes in the river waters.

**Acknowledgement**

The authors are thankful to the Principal and Management, Siddharth College of Arts, Science and Commerce, Fort, Mumbai for providing necessary facilities.

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