Eco. Env. & Cons. 29 (January Suppl. Issue) : 2023; pp. (S25-S28)
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ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2023.v29i01s.005

Analysis of Sewage Water Quality in and Around Mulund Region of Mumbai, India

Ganga Sankaranarayanan, Ritika R. Kumbhar, Anjali P. Nair, Ranjitsing Bayas and Seema Shinde

Department of Life Science, Ramnarain Ruia Autonomous College, L. Nappo Road, Matunga (E), Mumbai 400 019, Maharashtra, India

(Received 2 May, 2022; Accepted 11 July, 2022)

ABSTRACT

Sewage wastewater is water discharged from the premises of a home after being used for various purposes by the community. Sewage wastewater contains microbial contaminants, plastic particles and traces of drugs that can threaten water and food safety and human health. The problem is acute in densely populated areas with limited treatment facilities. It can contain household or municipal waste that eventually flows into natural rivers and oceans. Recording the quality of water discharged into streams is critical to maintaining the health of our ecosystems. This research work aims at analyzing the water quality of Mulund's wastewater. The results showed the presence of toxic raw chemicals affecting a variety of important parameters such as pH, conductivity and microbial community. This hazardous water quality could not only affect marine life but also leads to various diseases among the people living in the slums nearby in the absence of proper sanitation measures. This sewage is left untreated, requiring local and national wastewater treatment measures.

Key words: *Sewage water, Temperature, pH, Dissolved Oxygen, Conductance, Water quality,*

Introduction

Mumbai's current population is 12.91 million which is the fourth largest in the world. The National Institute of Environmental Engineering (NEERI) predicts that the city's population will reach 13.35 million by 2034. Mumbai's wastewater treatment system dates back to British times and is about 130 years old (Subbaraman *et al.,* 2013). Environmentalists say the sewage system is a major issue for Mumbai's rapidly growing population. It took the private government 32 years to develop a master plan for the treatment plant. The master plan was conceived in 1979 when the city's population was just over 71 million. With the help of the World Bank, this project was implemented in 2003. According to the plan, Mumbai is divided into 7 sewer districts. They have been identified as Colaba, Worli, Bandra, Versova, Malad, Bhandup and Ghatkopar. It consisted of 1,830 km of sewerage network, accomplished in 2003 with the support of the World Bank when the city's population was just over 71 million (Singh, D., 2021). Mumbai's 1,830 km sewer network is parted into 7 sewerage districts, mainly defined as Colaba, Worli, Bandra, Versova, Malad, Bhandup and Ghatkopar. The most evasive part of the master plan is the sewage wastewater treatment plant set up in these seven districts. According to the National Green Tribunal's latest order, the future sewage treatment plant in Colaba, Mumbai's the only future sewage treatment plant that will adequately treat sewage wastewater to the required standards before

(a)

(b)

Fig. 1. Sewage waste along the stretch of Mulund East (a) Transverse view (b) Lateral view

the water is dumped to the nearest water reservoir (Singh, 2021). The remaining sewage wastewater treatment plants pump about 1.84 billion liters of raw sewage directly into fresh or brackish water daily.

Materials and Methods

Sample was collected from the sewage water in the stretch of Mithagar Road, Mulund east. A bottle was inserted down the sewage with the help of a rope tied to the bottle's neck. It was made sure that the collection of the sample was done according to the standard sampling conditions.

Tests Conducted

The following tests were conducted on the sample collected using different techniques.

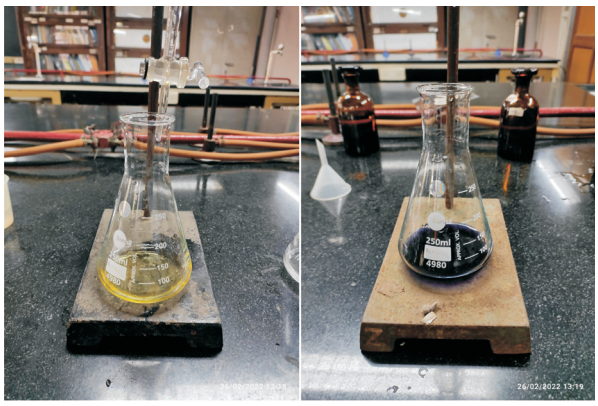
Table 1.

Sr.No.	Parameter Studied	Method used
1.	Dissolved Oxygen	Winkler's method
2.	Temperature	Conductivity meter
3.	Conductivity	Conductivity metre
4.	pH	pH paper
5.	Color	Visual Appearance

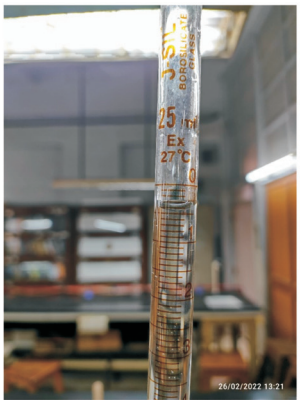
Tests Performed

Estimation of Dissolved Oxygen

Dissolved oxygen refers to the level of free or unbound oxygen present in any liquid. Dissolved oxygen is an important parameter in gauging the water quality since it influences the life of organisms living in a water body. In limnology, it is an essential factor second only to water itself. With a dissolved oxy-



(a) **(b)**



(c)

Fig. 2. DO of Sewage water sample (a) Before titration (b) After titration (c) Burette reading

gen level that either is too high or too low can harm aquatic life and affect water quality.

Calculation:

1 nEq, (milliequivalent) = Normality × Volume
1 mEq of $S_2O_3 \cong 8$ mg of O_2

$$0.025N \times CBR \text{ of } S_2O_3 = \frac{CBR \times Normality \text{ of } S_2O_3 \times B \times 1000}{Volume \text{ of } Sample}$$

$$Dissoleved\ Oxygen\ in\ sewage\ water\ sample = \frac{0.4 \times 0.025 \times 8 \times 1000}{25}$$

Dissolved Oxygen content = 3.2 mg/L

Estimation of Temperature and Electrical Conductivity

Electrical conductivity is the ability of a solution to pass electric current. It is determined using a device called conductometer or conductivity meter. It is a mobile instrument for on-site measurements. It consists of a probe and a display meter. Change in voltage, due to variation in the number of ions in the solution, is detected by the probe. It is then displayed on the meter. The meter converts this reading to milli- or micromhos or milli- or microSiemens per centimeter. Conductivity is a temperature dependent parameter. Therefore, the device consists of another probe which can detect the temperature of the solution. Immersing both the probes simultaneously into the solution allows for detection of both temperature and conductivity.

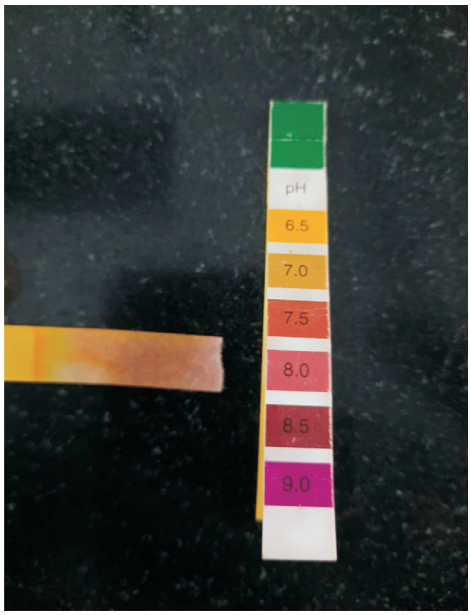


Fig. 3. pH test of Sewage water sample

Estimation of pH

pH paper is a special strip of paper prepared by dipping the strip in different chemical compounds and then drying it. It can be put to find the approximate pH of any solution. These papers change color when immersed in acidic or basic solutions. To determine the pH of a sample solution, the pH paper is dipped in the given sample solution and the color developed within the paper is directly compared with the color chart attached to the pH paper bundle and the approximate pH of the solution can be identified. It is commercially of great importance and available as test papers.

Estimation of Color

The color of water is estimated by visual appearance by comparing the water sample with a standard i.e., distilled water.

Results and Discussion

The dissolved oxygen water levels in sewage water are lower than that of standard sewage water (AWWA, 1995). It is due to the presence of toxic untreated substances. If this water is let into natural water bodies, it may be toxic to aquatic life since they need greater levels of dissolved Oxygen for survival.

The temperature of the water falls under the normal range. However, it is lower than the temperature recorded in the month of February.

The conductivity of the sample is less than the permissible value of 250-2250 µS/cm. This decrease is due to the dissolved minerals present in the untreated sewage wastewater (Basra *et al.*, 2014). According to a study (Westgate and Park, 2010), conductivity helps in determining the use of water for irrigation purposes. This sewage water cannot be used untreated for agriculture or irrigation purposes due to inappropriate concentration of ions. Conductivity values provide a measure to process the water for a proper sewage treatment. The pH is in the higher range and therefore the water exhibits slightly alkaline properties. When discharged into the natural water bodies, it may also higher the pH level of the natural water body (Gupta *et al.*, 2009). Higher pH is toxic for aquatic organisms and it will be difficult for their survival (MPCB, 2005). The color of the water was seen as brownish gray. This is due to the human waste that is being released and

Table 2.

Sample	Dissolved Oxygen	Temperature (!)	Conductivity (mS/cm)	pH	Color
Sewage	3.2 mg/l	28	160	8.0	Brownish gray
Standard	0.1 to 0.3 mg/l	10 to 21	3.61 ± 1.28	7.0-10.0	Dark

the pollution since the sewage is being left open.

Conclusion

The water from this sewage cannot be discharged into natural water bodies as this water contains high amounts of toxic substances which can affect the aquatic flora and fauna (Mohite *et al*., 2022). Further tests such as hardness, BOD, COD can be performed to further estimate the toxicity of water. The water can also be tested for the presence of coliforms (Janna, 2016). The sewage from which water was collected is left open which poses not only a hazard in terms of accidental falls, but also the health risk that could be further associated. Awareness should be brought among the people living nearby the sewage, so as to help them live a healthier life. Mumbai stands under a really critical scenario when we talk about sewage water treatment. The first plan of MSDP-II included that the treatment for creeks or nullah discharge would be at a higher level whereas the treatment for sea water discharge would be at standard level as there is more dilution in sea. The sewage disposal in Mumbai costs around half a lakh Indian rupee according to a recent survey (Gupta, 2017). This research provided a deeper insight into the present scenario about sewage waste disposal. It helped in understanding the current stand in terms of pollution to nature and environment. Along with the Government, the citizens also need to contribute to stop the rising pollution and to make the world a better place to live for current as well as future generations.

Acknowledgement

We would like to thank Principal Dr. Anushree Lokur and Life Science Head of the department Dr. Seema Shinde of Ramnarain Ruia Autonomous College, Mumbai for their motivation and encouragement. We would also like to thank the non-teaching staff of the Life Science Department who were a tremendous help in conducting our experiments.

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