Study of a metropolitan river: Mithi

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Abstract - *'Mithi' means sweet in Hindi, but the story surrounding the Mithi River has increasingly soured over the decades. While it served as a key storm water drain for Mumbai in earlier years, the Mithi has been gradually reduced to a dump yard for most locals who live along it. Mumbai's 15km long Mithi River a.k.a 'Mahim River' is formed by the confluence of tail-water discharges from the lakes in Powai and Vihar. It's origin is the Vihar Lake, whose overflow mingles with that of Powai Lake a couple of kilometers further on and terminates in the Arabian Sea at Mahim Creek. Along the way, it flows through several residential and industrial areas. While it served as a key storm water drain for Mumbai in earlier years, Mithi river has been reduced to a dump yard for most locals who live along it. Parameters such as pH, D.O, total hardness, alkalinity, nitrates and phosphates were analyzed and it was observed that most of the parameters exceeded the standard norms.*

***Key Words*: Mithi river, Mumbai, environment, hazardous water, monsoon, aquatic parameters, etc**

1. INTRODUCTION

Mumbai, the financial capital of India and a city which is home to 20million people consists, a river named 'Mithi'. The Mithi river flows through the heart of Mumbai cutting ways through slums, mangroves, residential and commercial areas. The Mithi river originates in the protected area of the Sanjay Gandhi National Park in the Western Ghats which is home to numerous species of flora and fauna. The initial stream merges with the overflow of Tulsi, Vihar and Powai lakes to form a river. The river flows through the densely populated areas of the Mumbai metropolitan region. The river flows through various slums including Asia's largest slum—Dharavi. Almost 70% of the river banks are occupied by lakhs of slum units from where domestic waste and even open defecation waste flows into the river. Moreover, several small-scale industries in these slum clusters pollute the river with their quite often toxic waste. In its initial stretches the river is narrow and has a faster flow but as the river progresses it gets wider and the flow decreases. The amount of pollution in the river is such that the color of the river turns black just before merging into the Arabian Sea. The disposal of waste such as plastic has led to a situation in which the flood water gets accumulated and is not able to be transported into the Arabian Sea. Hence, it plays a huge role in controlling the situation of water during floods. The study of the chemical parameters of the river was done at three intermediate stations(P1,P2 and P3) with different geographical features and demographics. The samples from the stations were collected on two different occasions with a time gap of 60 days in between.

(Fig:1a)

Sr No.	Location of Station	Features
P1	Chhatrapati Shivaji International Airport (Sakinaka)	Dense slums and airport waste disposal
P2	Shanti Nagar, Kurla	Dense slums and waste from industries
P3	Sion-Bandra Link road, BKC	Water from Vakola Nala merges with Mithi river

1.1 List of Equipments used

Sr No.	Parameter	Apparatus and Methods
1	pH	pH meter
2	Total Hardness	Complex titration by EDTA
3	BOD(Biological Oxygen Demand)	Winkler's method using azide modification
4	COD(Chemical Oxygen Demand)	Potassium Dichromate open reflex method
5	Chlorides	Silver Nitrate Method
6	Nitrates and Phosphates	Ultraviolet Spectrophotometer

1.2 pH

The pH of the points P1,P2 and P3 was recorded on the first trial to be 7.10, 6.96 and 6.33. Whereas, in the second trial(during monsoon) the pH values for P1,P2 and P3 were 7.18, 7.10 and 6.70 respectively. It could be inferred from the trials that there was minimal effect of the monsoon on the pH levels of the river. Whereas, the pH value of point P3 remains lower than P1 and P2. This could be due to the confluence of Vakola nala which merges with the Mithi River a few hundred metres before P3.

Sr No	Trial 1	Trial 2	Average
P1	7.10	7.18	7.14
P2	6.96	7.10	7.03
P3	6.33	6.70	6.52

1.3 Dissolved Oxygen

Dissolved Oxygen(DO) is the amount of oxygen in water to sustain life. Dissolved oxygen keeps check on the aquatic ecosystem and is one of the most essential parameters. The amount of DO in first trial at stations P1,P2 and P3 was 0.65, 0.61 and 1.15 respectively. Whereas, the amount of dissolved oxygen in the second trial during monsoon for stations P1,P2 and P3 was 0.40, 0.52 and 0.93 respectively (all values in mg/L). It must be noted that a minimum of 5mg/L dissolved oxygen concentration is required for aquatic life to sustain.

Sr No	Trial 1	Trial 2	Average
P1	0.65	0.40	0.53
P2	0.61	0.52	0.57
P3	1.15	0.93	1.04

1.4 Biological Oxygen Demand

Biological Oxygen Demand represents the amount of oxygen required by aerobic organisms. BOD is dependent upon the presence of organic matter. It was observed that the values of Biologically Oxygen Demand were higher in polluted areas. The values of BOD at points P1,P2 and P3 in the first trial were 212, 282 and 310 respectively. Similarly, the values of BOD during monsoon were 180, 266 and 271(all values in mg/l) for stations P1,P2 and P3 respectively. It was observed that the values of Biological Oxygen Demand were higher during the pre-monsoon period.

Sr No.	Trial 1	Trial 2	Average
P1	212	180	196
P2	282	266	274
P3	310	271	291

1.5 Chemical Oxygen Demand

Chemical Oxygen Demand is used to measure the organic pollution of water. The oxidation process of the organic matter and chemical compounds demands oxygen. The average concentration levels for stations P1,P2 and P3 were 376, 430 and 491. The concentration in the pre-monsoon period was found to be 474, 537 and 680 for location P1,P2 and P3. Similarly, the COD values during monsoon were 278, 323 and 301 respectively.

Sr No	Trial 1	Trial 2	Average
P1	474	278	376
P2	537	323	430
P3	680	301	491

1.6 Total Hardness

To check if the water is fit for domestic as well as industrial purposes, hardness of the water needs to be in the optimal range. Hardness of water is controlled by factors such as Ca^{2+},Mg^{2+},Mn^{2+},Fe^{2+},Sr^{2+},OH^{-},CO_3^{2-},HCO_3^{2-} etc. The concentration of total hardness in the pre-monsoon period was found to be 182,248 and 291 for stations P1,P2 and P3 respectively. Whereas, the concentration for the monsoon period of total hardness was found to be 192,305 and 266 respectively. It could be inferred from the above data that there was no significant change in the average total hardness with respect to time or rainfall.

1.7 Chlorides

Chlorides are another element which are present in water. Chlorides are used to kill micro-organisms present in water and are also used as bleaching agents. The permissible limit for chlorides in water is up to 250mg/l. Any value above this would lead to pollution in water and the water would be classified as unfit for domestic as well as industrial purposes. The concentrations of chlorides obtained from location P1,P2 and P3 in the first trial were 9221, 11098 and 17164. Whereas, in the second trial were 7650, 9531 and 13664 respectively. The chloride concentration at location P3 is high due to the influence of sea.

Sr No	Total Hardness			Chlorides		
	Trail 1	Trial 2	Avg.	Trial 1	Trial 2	Avg.
P1	182	192	187	9221	7650	8436
P2	248	305	277	11098	9531	10315
P3	291	266	279	17164	13664	15414

1.8 Nitrates and Phosphates

Excess amount of Nitrates in a water body can lead to water pollution and a phenomenon called as eutrophication. The maximum limit for Nitrates as per the ISI is 45mg/l. Higher values of nitrates indicate higher organic pollution. The concentration of nitrates at sampling point P1,P2 and P3 in the pre-monsoon period was found to be 134, 113 and 108 respectively. In the second trial during the monsoon period, the concentration of nitrates were found to be 88, 81 and 76 respectively.

Mixing of industrial waste and effluents leads to an increase in phosphate concentration in water. Higher concentration of phosphate is also a cause for eutrophication. The natural phosphate levels in water bodies range from 0.005mg/l to 0.05mg/l. The concentration of phosphate that was found during sampling at location P1,P2 and P3 were 0.210, 0.242 and 0.330 respectively. During monsoon, the concentration of phosphates recorded were 0.155, 0.195 and 0.225 respectively.

Sr No.	Nitrates			Phosphates		
	Trail1	Trial2	Avg.	Trial1	Trial2	Avg.
P1	134	88	111	0.210	0.155	0.183
P2	113	81	97	0.242	0.195	0.219
P3	108	76	92	0.330	0.225	0.278

CONCLUSIONS

From the above parameters, it can be inferred that the water in the Mithi river is polluted and most of the physical and chemical parameters exceed the normal limits. The water coming in pure form from the lakes of Mumbai and Sanjay Gandhi National Park is polluted as soon as it enters the heart of the city. Some suggestions for the betterment of Mithi river include:

(1) Strict laws and punishment for those who litter in and around the river.

(2) Plastic has been banned, but still the littering of plastic is seen throughout the path of the river which decrease the flow of the river. The river should be thoroughly cleaned.

(3) Small scale industries in Dharavi directly dispose the effluents and sludge into the Mithi river. This needs to be changed. An alternative for the same should be worked upon by the State Government and BMC.

(4) Setting up of sanitation facilities in the slums should be done so the excreta of the residents of the slums do not directly go into the river.

(5) Illegal construction along the banks of the river should be looked upon and be shifted to some other locations.

A country like India in which river bodies are considered holy, the only river in the financial capital of India is fighting for its existence. Its time all the citizens and the civil bodies come along to save it.

ACKNOWLEDGEMENT

I would like to thank the members of the Department of Civil Engineering, Thakur College of Engineering and Technology for helping me use the laboratories for carrying out the experiments and helping me in the research.

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