PHYSICOCHEMICAL ANALYSIS OF MULA MUTHA RIVER PUNE

Pali Sahu[1], Sonali Karad[2], Sagar Chavan[2] and Sourabh Khandelwal[2]

[1]Asst.Prof. Environmental Engineering, Civil Department, VIIT, Pune, India

[2]U.G. Student, Civil Department, VIIT, Pune, India

ABSTRACT

Mula-Mutha River in pune (India) is one of the most vulnerable water bodies to pollution because of their role in carrying municipal and industrial wastes and run-offs from agricultural lands in their vast drainage basins. Despite of the various standards and laws made by government many industries were discharging their waste directly into the river making its quality poor day by day. The restoration of river water quality has been a major challenge to the environmental managers. Detailed research and analysis is needed to evaluate different process and mechanism involved in polluting water. The aim of the work under the title is to analyze the river by dividing it into various sampling station. The present study also identifies the critical pollutants affecting the river water quality during its course through the city. The indices have been computed for pre-monsoon, monsoon and post-monsoon season at four locations, Khadakwasla , Sangamwadi, Vithalwadi &Bund Garden. It was found that the water quality ranged from satisfactory to marginal category at Khadakwasla and fell under very poor category at all other locations. This research have a vast future scope as the rapid industrialization results in formation of toxic contaminants leading to enormous damages to environment directly putting the lives at risk. Thus, this gathered information would be handy and helpful for preventing or at-least reducing the hazardous impacts.

KEYWORDS

Water pollution; Mula Mutha River; Industrial Effluent; Domestic Sewage; Agriculture Runoff; Physico-chemical characteristics; BOD; COD; pH; Turbidity; Hardness

1. INTRODUCTION

Increase in globalization and industrialization country faces the various challenges for providing clean and safe water to the public. As more number of rivers is getting polluted, the acting bodies such as municipalities are finding it difficult to treat river water to safe levels and supply it to people. In terms of its fast growth and development, Pune city becomes one of the growing and emerging cities of India (1). More and more people from outside town and cities are migrating into Pune city. The population increase in Pune city during the last 2-3 decades has been particularly rapid with a resultant effect on the increase of water pollution level. To serve the vast population, only one sewage treatment plant is there in Pune city, which has a capacity of 90 MLD (million liters per day). The plant has almost 50%-55% efficiency of treating waste water and remaining untreated effluents are usually discharged into the rivers directly (4, 5).

Mula-Mutha River is one of the major vulnerable river of Pune city. Mula originates from Mulshi dam & it passes through Paud, Lavasa, Wakad, Balewadi, Baner, Aundh, Khadki, Vishrantwadi and ends at Sangamwadi.

Mutha river origin from Khadakwasla dam & it passes through Dhari, Nanded, z-bridge, Juna-bazzar, Pune RTO and ends at Sangamwadi. Both Mula and Mutha River merged at Sangamwadi which is further joined by Indrayani & Bhima River (6). Due to rapid development of city the pollution load into river Mula - Mutha has been increased as this river is passing from major areas of Pune. Industrial areas having industries like Hindusthan antibiotics, Teleco, Bajaj Auto, paper mills and others hundreds of small scale industries (2, 3). Various small scale industries as well as some large scale industries use CETP for the treatment of their effluent but according to survey (CPCB) many CETP are not maintaining various effluent standards before discharging their water in to the river, which ultimately leads to pollution.

Mula is considered to be the lifeline of the Pune city. The water of Mula River is used for drinking, bathing, industrial and irrigation purposes. The increasing urban and industrial activity influences the water quality of Mula River both the river covers almost whole city. Hence it receives disposal of solid wastes, domestic waste, hospitals and industrial effluents and some amount of agricultural runoff.

Various authors had done analysis on Mula Mutha River some of them are:

D.G. Kanase et al studied the physicochemical characteristics of major River of Pune city in 2005. They studied and analyzed the Pawana & Mula and Mutha River. The analysis was carried out for the parameters namely pH, Acidity, Alkalinity, Total Hardness, Calcium, Magnesium, Chloride, Nitrate, Sulphate and Phosphate. The data obtained by the analysis revealed that the pH is between 7.5 & 8.6, DO, Chloride, Nitrate, Sulphate and Phosphate are within the desirable limits.

Chandanshive Navnath Eknath et al also did the analysis on Mula Mutha River in 2013. Their paper highlights the pollution level and their impact on aquatic life. According to their studies 72 species were reported in 1942 in the river. It has been observed by the various studies that fish diversity is gradually decreasing since last 14-15 years, mainly due to increase in population and pollution load. The physico-chemical aspects of water pollution of Mula-Mutha Rivers was analysed seasonally. It is observed during their reserch that the level of pollution was optimum during post-monsoon and pre-monsoon seasons. In the polluted stretch of this river, many tolerant as well as air breathing fish H fossils are found at many places

A. ***B. More, C.S. Chavan et al*** carried out the analysis of Mula Mutha River in 2014. As per result analysis, it is found that some stations are highly polluted. Different stations are polluted by different pollutant like solid waste, chemical waste, organic &inorganic waste.

In present study the analysis area is confined to stretch of rivers Mula and Mutha. Mula River receives heavy loads of agricultural runoff through non point sources. Mutha River since it passes through the city of Pune receives heavy loads of domestic sewage with some industrial waste (7).

Main objective of this study is:

- To analyze the present pollution level of river.
- To find out most populated zones.
- To find various sources of pollution and to suggest the remedies for the same.

2. METHODS AND MATERIALS

2.1 Selection of sampling stations

In order to analyze the effects of pollution, stretch of the river, starting from Khadakwasla to bund garden various station points were selected for sampling. A total of 4 locations were selected along the stretch of the river.

STATION NO.	NAME OF SAMPLING STATION	RIVER
S1	KHADAKWASLA DAM	MUTHA
S2	VITTHALWADI	MUTHA
S3	SANGAMWADI	MULA AND MUTHA
S4	BUND GARDEN	MULA AND MUTHA

Figure 1: Station 1-Kadhakwasla dam

Figure2: Station 2-Vitthalwadi

Figure3: Station 3-Sangamwadi

Figure4: Station -4 Bund Garden

2.2 Water sampling:

Samples must be taken from locations which are representative of the water from sources, treatment plants, storage facilities, distribution network and household connections. Samples were collected for three seasons i.e. Pre-Monsoon, Monsoon & Post-Monsoon. The samples were of Grab samples & collected in sterilized bottles using standard procedure (APHA 1995)

2.3 Parameters to be measured:

1. pH
2. Total Hardness
3. Turbidity
4. Dissolved oxygen
5. Biochemical Oxygen Demand
6. Chemical Oxygen Demand

3. RESULTS & DISCUSSION:

Table1: Sampling Point variation in Monsoon Season

Sr No.	Parameter	S_1	S_2	S_3	S_4
1	pH	7.82	5.24	5.62	5.76
2	Turbidity	04	15	11	07
3	Hardness	13	92.58	75	112.2
4	DO	3.2	0.5	0.7	1.9
5	BOD	09	30	42	46
6	COD	48	40	52	62.5

Table2: Sampling point variation in Pre Monsoon Season (Summer)

Sr No.	Parameter	S_1	S_2	S_3	S_4
1	pH	8.40	6.71	7.71	6.48
2	Turbidity	03	21	11	09
3	Hardness	30.12	83.96	112.64	77.76
4	DO	2.3	0.8	0.4	0.4
5	BOD	9.5	28	31	51
6	COD	44	39	42	58

Table3:Sampling Point variation in Post Monsoon Season (Winter)

Sr No.	Parameter	S_1	S_2	S_3	S_4
1	pH	9.48	8.12	7.37	6.56
2	Turbidity	06	14	15	09
3	Hardness	30.16	102.44	104.68	124.04
4	DO	2.1	0.7	0.6	0.3
5	BOD	08	42	39	42
6	COD	40	45	58	73

3.1 pH:

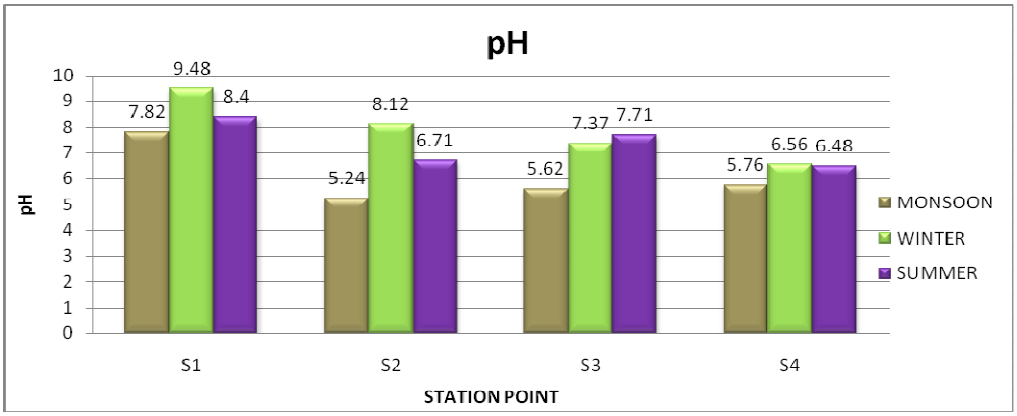

Figure 5: pH

The weekly fluctuations of pH were observed at all the sampling stations of Mutha and Mula River. The minimum pH of the surface water is 5.24 at sampling station S2 (Vitthalwadi) and maximum is 9.48 at station S1 (Khadakwasla). pH levels normally vary due to environmental influences, particularly Alkalinity. The variation of result may be due to the presence of dissolved salts and carbonates of the surrounding soil.

3.2 Turbidity:

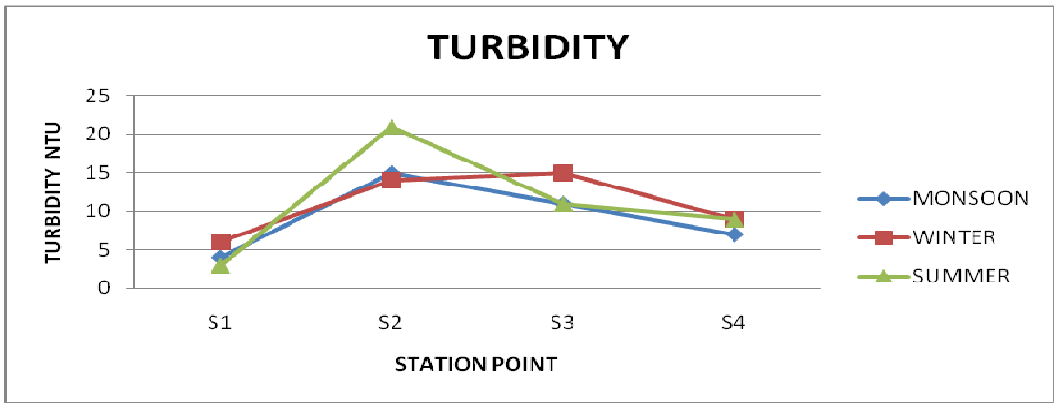

Figure 6: Turbidity

The turbidity mainly depends on flow condition of water. The minimum turbidity is 3 NTU at station S1 and maximum turbidity is 21 NTU at station S2. It is observed that the turbidity at Khadakwasla Dam (S1) alone varies due to the disturbance created by the people and maximum at Vitthalwadi as all kinds of waste from temple is discharged directly into river. Overall Turbidity is high at Vitthalwadi and goes on decreasing downstream towards the Bund Garden.

3.3 Total Hardness:

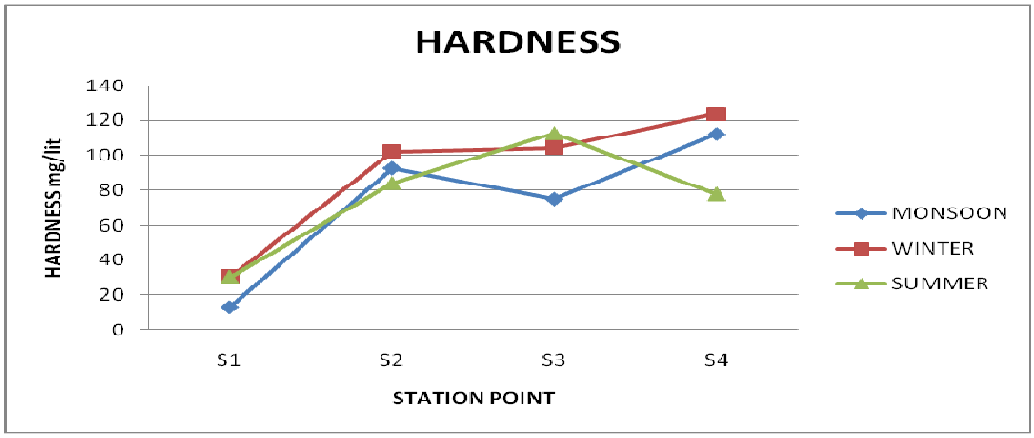

Figure 7: Total Hardness

The minimum hardness concentrations was 13 mg/l at sampling station S1 (Khadakwasla) in monsoon and maximum is 124.04 mg/l at sampling station S4 (Bund Garden) in winter season. At station S1(Khadakwasla) the hardness is minimum as there is no polluting factor is present, but from the station point S2 the pollution level of river starts and hardness level goes on increasing. Hardness is caused by various cations such as calcium and magnesium. Hardness may be caused by natural accumulation of salts from soils and rocks. Also similar industrial waste may also increase hardness.

3.4 Dissolved Oxygen :

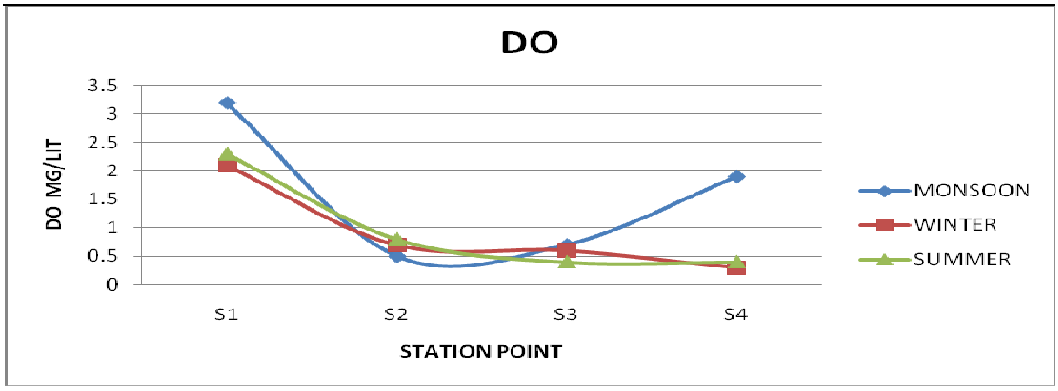

Figure 8: Dissolved Oxygen

In the present investigations DO concentrations was recorded minimum 0.3 mg/l at sampling station S4 (Bund Garden) and maximum was 3.2 mg/l at sampling station S1 (Khadakwasla).The variation in DO was due to the decrease in natural recharge of water and increase in concentration of waste. Since the wastewater undergo natural degradation process resulting lowering DO levels in summer months. In the present study DO concentration was decreased mainly at S2 & S3, due to additional flow of domestic waste, which is mainly organic matter, and other solid waste in to the water.

3.5 Biological Oxygen Demand:

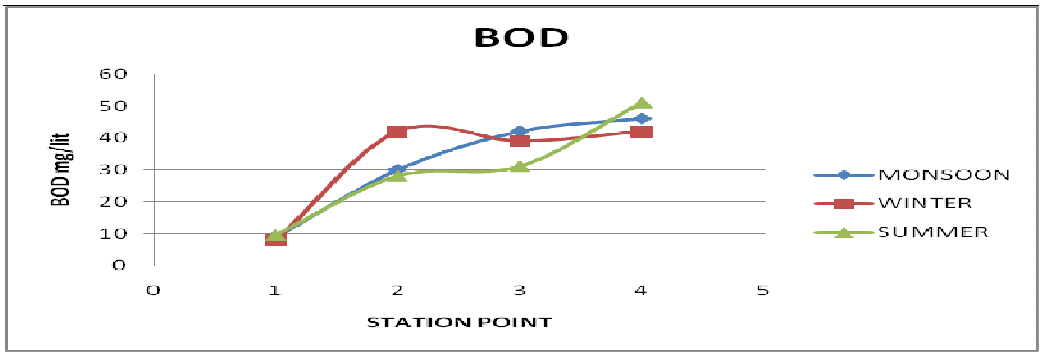

Figure 9: Biological Oxygen Demand

BOD is another key indicator parameter in assessing degree of pollution. The range of BOD was observed from minimum 8 mg/l at sampling station S1 (Khadakwasla) to maximum 46 mg/l at sampling station S4 (Bund Garden). At many place one could also see black spots spreading on the surface of water. There was nothing but deposited organic matters get an-aerobically degraded bringing up the waste and spreading on the surface. At this point river water showed zero or very less oxygen and highest BOD which affects aquatic life too.

3.6 Chemical Oxygen Demand:

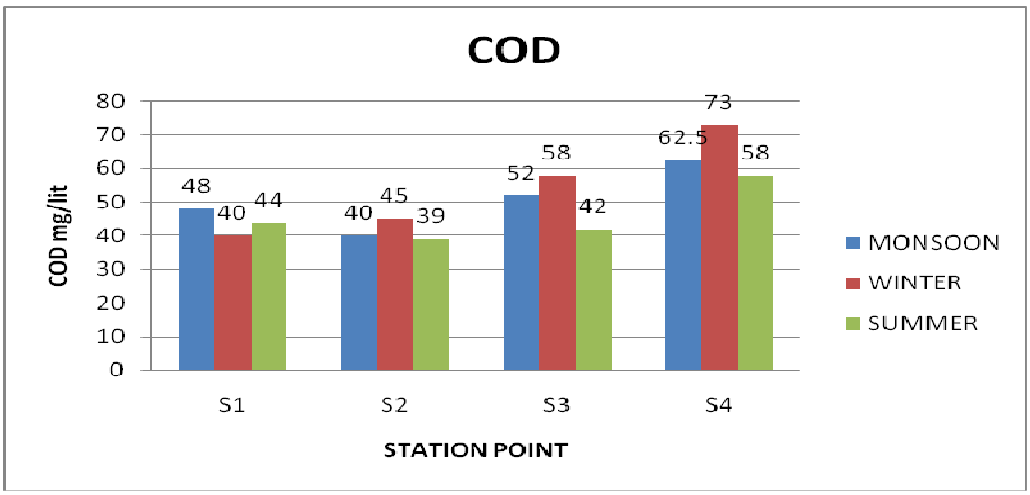

Figure 10: Chemical Oxygen Deamnd

COD is another key indicator parameter in assessing degree of pollution. The range of COD was observed from minimum 39 mg/l at sampling station S2 (Vitthalwadi) to maximum 73 mg/l at sampling station s4 (Bund Garden).

4. CONCLUSION:

Increasing Water pollution is a major problem in all the rivers. Contaminated water is the biggest health risk and continues to threaten both quality of life and public health. From our analysis on Mula Muta River we concluded following points:

1.The analysis and result clearly shows that river water quality has deteriorated mainly due to domestic sewage in case of river Mutha and industrial effluents in case of Mula River.
2.It is clear from the present analysis that the environment of the Mula and Mutha River showed increasing load of pollution. There is need to have proper collection and treatment of waste and need to regulate the flow.

5. FUTURE SCOPE:

According to our research, the major sources of pollution of river Mula -Mutha are presence of dissolved salts and carbonates of the surrounding soil, waste from temples, additional flow of domestic waste, industrial waste, and agricultural waste which is mainly organic matter, and other solid waste in to the water.

1.To reduce the pollution level of river & to decrease the load on treatment plant, some measures should be implemented. Some kinds of measures which will help in reducing the degradation and pollution level of river are as follow:

- Public Awareness

- Inspection of waste discharged by various industries and some limit should be fixed for parameters causing pollution.

- Prohibiting the public entries and interference with water quality at river banks.

- Periodic checking and inspection should be done for wastes discharged from hotels and other small scale industries.

REFERENCES:

1. A. A. Kazmi, Akansha Bhatia et al: A short screening study on water quality of Indian rivers and lakes :IWRS,Volume 33, No.3 July 2013
2. A. B. More, C.S. Chavan et al: Water Quality Status of Mula-Mutha River:GJRA, Volume 3,Issue 4,April 2014
3. Manohar G. Gavit, Manisha K. Sangale et al:Physicochemical Analysis of Flowing water of two Rivers of the Pune City, Maharashtra, India: IJCR, Volume 5, Issue 2, pp 232-235, Feb2013
4. Nidhi Jain, R. K. Shrivastava: Comparative Review of Physico chemical Assessment of Pavana River: IJSR ,Volume 3, Issue 8, August 2014
5. D.G. Kanase et al: physico-chemical assessment of krishna river at karad, satara district (maharashtra):IOSR, Volume 8, Issue 6,pp 25-32, June 2014
6. Ayodhya D. Khsirsagar: Diversity of Aquatic Fungi from Mula River at Pune City:IJALS,Volume 6, Issue 3,May 2013
7. Chandanshive Navnath Eknath et al: Studies On Effect Of Detergents On Fresh Water Fishs Mystus Montanus Selected From Mula River Pune:ISBN No. 978-81-909551-8-8,2013
8. A. B. More, C.S. Chavan et al: water quality status of mula mutha river:GJRA, Volume 3, Issue 4, 2014 Yang Li et al. 2009:water quality analysis of Songhua river using multivariate techniques
9. Allaa M. Aenab: Evaluation of Tigris River by Water Quality Index Analysis Using C++ Program:JWRP,Volume 4, No. 7, July2012
10. Bhargava DS (1983a) A light- penetration model for the rivers Ganga and Yamuna. Int J Dev Technol (England) 1(3):199–205
11. Bordalo AA, Nilsumranchit W, Chalermwat K (2001) Water quality and uses of the Bangpakong River (Eastern Thailand) 35(15):3635–3642