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Water pollution intensity analysis of Mula River in Pune using bod, cod and heavy metal concentration as primary parameters

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Abstract
The present investigation entitled "Water pollution intensity analysis of Mula river in Pune using BOD, COD and heavy metal concentration as primary parameters" was conducted during 2021-2022. The study was conducted by collecting 40 water samples along the Mula river water stretch in Pune from origin of Mula river to Sangamwadi area. Standard methods for analysing the BOD, COD and heavy metal concentration of water samples were adopted. The study showed that all 40 water samples had BOD and COD values below permissible limits of irrigation purpose. Whereas concentration of Ni, Cr and Cd was below 0.001 mg L^{-1}.

Keywords: BOD, COD, CPCB, Mula, WHO

Introduction
Water has always been one of the most precious and valuable gift of nature. It is safe to say that without water, it would be impossible for any living organism to survive on the earth. Water is essential for almost all living beings including various daily human activities. Use of water cannot be substituted by any other substances. Hence it is necessary to understand the importance of water. Quality of water is decided based upon its purpose of use. Depending on its use, quality of water varies. The requirement of water quality changes with its purpose of use. For example, water that is suitable for irrigation purpose cannot be vaguely used for drinking purpose by human beings. Hence, analysing the quality of water before its use has become inevitable.

In India, mainly there are two major sources of water: surface water and groundwater. Out of these two, highly reliable water resource is river water. Unfortunately, this highly important water resource is becoming severely polluted due to increasing population and contamination of water causing degradation in the quality of river waters day by day. Of course there are some ways of reducing this pollution. This includes increased number of water treatment plants/ sewage treatment plants installment as well as proper functioning of these plants across the river stretch. But, the sector of urban water is seriously mismanaged (Wagh *et al.*, 2008) [7]. Hence, monitoring the river water quality time to time will help in reducing the deterioration in river water quality.

The quality of water is decided based on various parameters like pH, electrical conductivity (EC), presence of carbonates and bicarbonates, chlorides and sulphates, heavy metals, biological oxygen demand (BOD), chemical oxygen demand (COD), etc. along with derived parameters like sodium absorption ratio (SAR), residual sodium carbonate (RSC), Kelley's ratio, etc. Concentration of certain substance in the water can alter the quality of water to a great extent. Hence it is very important to analyse the quality of water according to its purpose of use.

The present study was undertaken to study water quality of Mula river to assess the intensity of pollution for irrigation purpose of Mula river water on basis of BOD, COD and heavy metal concentration as primary parameter in Pune. For this purpose, water samples were collected at different locations along the course of Mula river in Pune city and analyzed for their chemical properties using standard laboratory procedures.

Study area
Pune is a city in Maharashtra lying on the western margin of Deccan plateau with total

geographical area of 15,643 km^2. The origin of Mula river is at Mulshi dam of Pune and has length of around 22-25 km in the Pune city from its origin to its confluence with Mutha river.

Average temperature of Pune ranges from 19 °C to 33 °C (66°F - 91°F). Whereas annual rainfall in the city is 722 mm.

Methodology

For study, 40 river water samples were collected along the stretch of Mula river, starting from Mulshi dam to Sangamwadi area before the confluence of Mula – Mutha rivers in the months of January 2022 and February 2022. These 40 Mula river water samples collected in 1 litre capacity thoroughly cleaned bottles and then transferred to laboratory at Division of Soil Science and Agricultural Chemistry, College of Agriculture, Pune for analysis. While collecting the water samples, sampling locations were also noted as shown in the Table 1.

For the analysis of Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD), standard titrimetric method (APHA, 2005) is used. Findings from the analysis are given in Table 2. The BOD of given water sample is calculated by using difference between amount of dissolved oxygen (DO) present in the water sample at day 1 and amount of dissolved oxygen present in the water sample at day 5 of incubation. While COD was estimated by using open reflux method (Table 2).

In case of heavy metal concentration, (i.e. for Ni, Cr, Cd), Atomic absorption spectrophotometer was used according to the standard method by Lindsay and Norwell (1978). Results from the analysis are given in Table 3.

Table 1: Sampling location at Mula river for BOD, COD and heavy metal analysis.

Sample no.	Location	Sample no.	Location
S1	Mulshi Dam	S21	After mixing Ramnadi water into Mula river
S2	Mulshi, Tamhini Ghat road	S22	Old Aundh bridge
S3	Sambve Gaon near Mulshi	S23	Aundh bridge, near Aundhgaon
S4	Disligaon	S24	Old Sangavi
S5	Jamgaon	S25	Botanical garden, in Ganeshkhind
S6	Asadegaon, Bhadas road	S26	Before Mula and Pawana confluence
S7	Akolegaon	S27	Before mixing STP water in Mula river at Bopodi
S8	Ruturang farmhouse, Poudgaon	S28	Bopodi
S9	Kondhwa Gaon	S29	After Mula and Pawana confluence
S10	Poud bridge	S30	After mixing STP water in Mula river at Bopodi
S11	Darivaligaon	S31	Bopkhel bridge at PCMC
S12	Mulshi agro tourism	S32	Alandi road
S13	Hinjewadi Pirangut bridge	S33	Holkar bridge, in Khadki cantonment
S14	Mulkhedgaon	S34	Khadki war cementry
S15	Chandegaon	S35	Wakdewadi bus stop
S16	Balewadi road, Mhalunghe	S36	Before Tanajiwadi STP
S17	Balewadi bridge	S37	After Tanajiwadi STP
S18	Before Baner water treatment plant	S38	Sangamwadi Bridge
S19	After Baner water treatment plant	S39	Before Mula and Mutha confluence
S20	Before mixing Ramnadi water into Mula river	S40	Sangamwadi

Results and Discussion

1. Biological Oxygen Demand (BOD)

The results obtained from analysis of water samples based on BOD values are given in Table 2 and Fig 1. From the data, it was observed that all 40 samples of Mula river showed BOD values in suitable range (i.e. from 6 mgL^{-1} - 15 mgL^{-1}). This showed that the river water belonged to suitable category of BOD according to CPCB limits (Table 3). However, BOD showed consistent increase from Mulshi dam to Sangamwadi area. This indicated increase in the organic load in the river water as the river flows from origin to city area. From Mulshi dam onwards, the river faces addition of pollutants from various sources like wastewater addition through nalas, dumping of hospital and industrial waste in the water causing increase in organic pollution in the river. Similar results were observed in the previous study of BOD of Mula river water conducted by Shinde *et al.* (2018) [5].

2. Chemical Oxygen Demand (COD)

The results obtained from analysis of water samples based on BOD values are given in Table 2 and Fig 2. The data revealed that in case of COD, all 40 samples of Mula river were within the suitable range of CPCB limits (i.e. within 250 mgL^{-1}). The samples ranged from 11 mg L^{-1} to 208 mg L^{-1}. This showed that the river was in suitable condition in case of COD. From Mulshi Dam to the Sangamwadi area, COD exhibited a continuous increase except at some sampling locations. This increase showed presence of untreated or partially treated sewage in river water. The presence of excess organic matter favours microbial growth and reduces available dissolved oxygen (Abhyankar *et al.*, 2020) [1]. The samples collected after mixing of STP outlet water in the river water showed less COD than previous locations. These results obtained were closely similar with earlier findings recorded by Shinde *et al.* (2018) [5].

3. Heavy metal concentration (Ni, Cr, Cd)

The data represented in the Table 3 shows results of analysis of irrigation water samples on the basis of Ni, Cr and Cd concentrations. According to the data, all 40 samples showed heavy metal concentration in below permissible limit as shown in Table 4. All three heavy metals i.e. nickel, cadmium and chromium were observed to be below 0.001 mg L^{-1}. This indicated that river water showed no harmful levels of heavy metal concentration from Mulshi dam to confluence of Mula river with Mutha river i.e. at Sangamwadi bridge area. Similar results were found in the previous study conducted by Nawani *et al.* (2016) [4].

Table 2: BOD, COD observed in water samples collected from Mula river.

Sample no.	BOD (mg L^{-1})	COD (mg L^{-1})	Sample no.	BOD (mg L^{-1})	COD (mg L^{-1})
S1	6	11	S21	10	116
S2	6	14	S22	12	122
S3	6	44	S23	13	128
S4	6	56	S24	13	135
S5	6	64	S25	13	138
S6	7	71	S26	13	139
S7	7	78	S27	13	42
S8	7	82	S28	11	89
S9	8	94	S29	12	94
S10	9	101	S30	10	57
S11	9	121	S31	10	68
S12	9	119	S32	10	82
S13	10	126	S33	12	97
S14	10	128	S34	13	110
S15	11	133	S35	13	125
S16	11	135	S36	13	131
S17	11	146	S37	11	102
S18	11	50	S38	13	136
S19	9	92	S39	14	196
S20	9	105	S40	15	208

Table 3: Permissible limits of BOD and COD

Parameter	CPCB		WHO (1995)
	Inland surface waters	Land for irrigation	
BOD (mg L^{-1})	30	100	100
COD (mg L^{-1})	250	-	300

Table 4: Recommended maximum concentrations of heavy metals in irrigation water given by FAO (1985).

Heavy metal	Recommended maximum concentrations (mg L^{-1})
Nickel (Ni)	0.2
Chromium (Cr)	0.1
Cadmium (Cd)	0.01

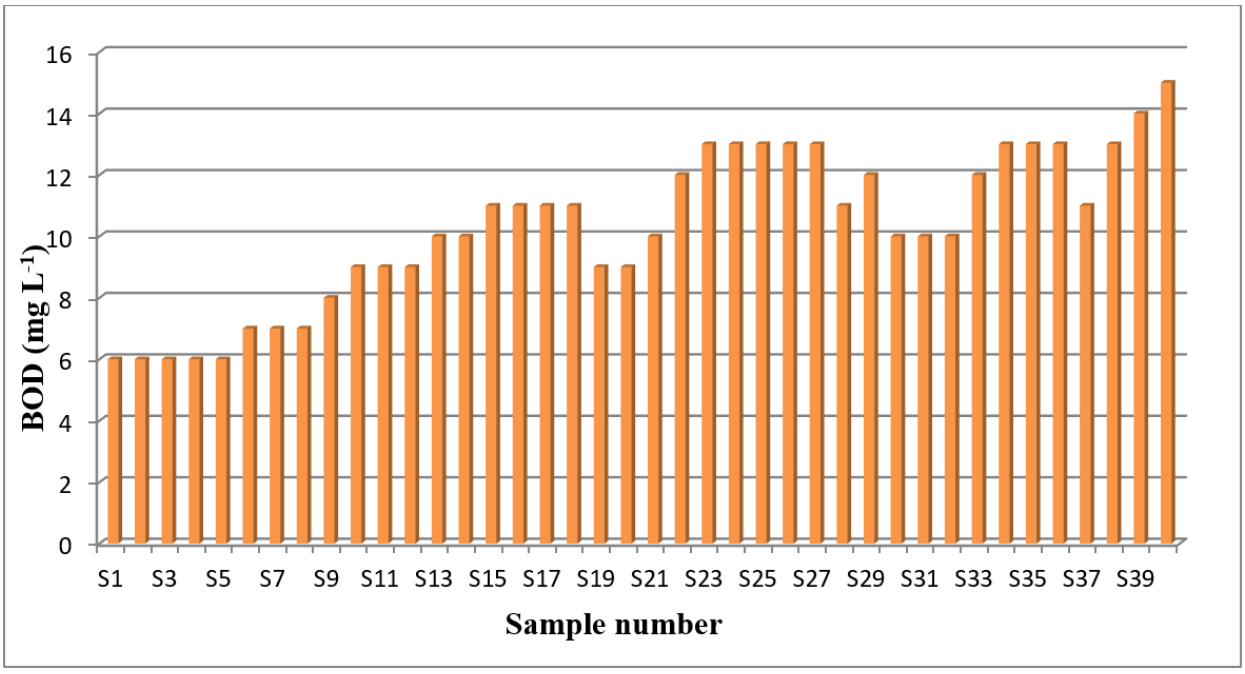

Fig 1: Location wise variation in Biological Oxygen Demand (BOD) values

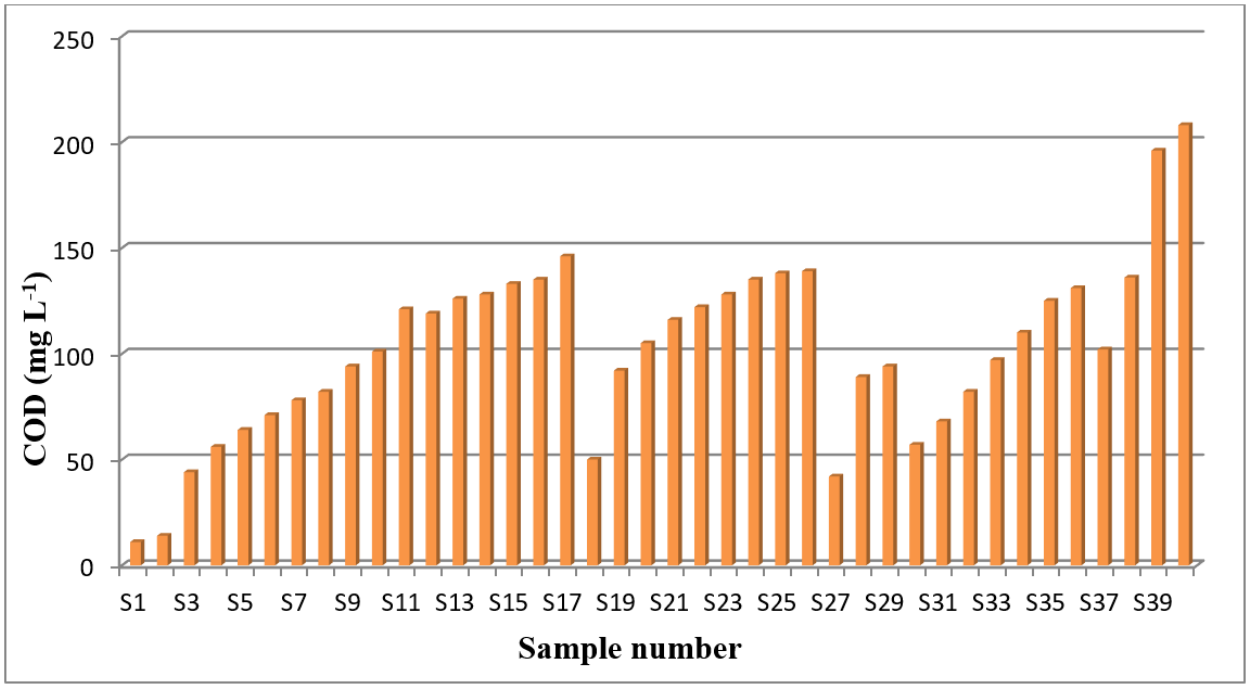

Fig 2: Location wise variation in Chemical Oxygen Demand (COD) values

Table 3: Heavy metal concentration observed in water samples collected from Mula river.

Sr. no.	Heavy metal concentration	Classes	Number of samples in class	Percent of sample	Analytical range
1.	Nickel	Class 1 (upto 0.2 mgL^{-1})	40 samples	100%	Below 0.001 mgL^{-1}
		Class 2 (more than 0.2 mgL^{-1})	-	-	-
2.	Chromium	Class 1 (upto 0.1 mgL^{-1})	40 samples	100%	Below 0.001 mgL^{-1}
		Class 1 (more than 0.1 mgL^{-1})	-	-	-
3.	Cadmium	Class 1 (upto 0.01 mgL^{-1})	40 samples	100%	Below 0.001 mgL^{-1}
		Class 1 (more than 0.01 mgL^{-1})	-	-	-

Conclusion

BOD and COD of river water were found within permissible limits of irrigation purpose but minimum at Mulshi dam and maximum at Sangamwadi Bridge area which indicated consistent increase in the organic pollution of river water. Concentration of nickel, cadmium and chromium in river water were within the permissible limits hence suggested no heavy metal pollution in the river water from Mulshi dam to Sangamwadi Bridge area.

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References

1. Abhyankar PS, Ambade SV, Patwardhan R. Water pollution analysis of Mutha river across Pune city using BOD as primary parameter. Pollution Research. 2020;39:S70- S74.
2. Ortyom YG. Water pollution: A menace to aquatic eco-diversity and human health: A review. Int. J Agric. Food Sci. 2021;3(2):47-53. DOI: 10.33545/2664844X.2021.v3.i2a.74
3. Lindsay WL, Norwell WA. Development of DTPA soil test for Zinc, Iron, Manganese and Copper. Soil Science Society of American Journal. 1978;42:421-428.
4. Nawani, Neelu, Rahman, Aminur, Nahar, Noor, *et al.* Status of metal pollution in rivers flowing through urban settlements at Pune and its effect on resident microflora. Biologia. 2016;7(5):494-507.
5. Shinde S, Singh V, Jain V, Singh V, Bhoge S, Mehta H. Water quality analysis of Mula River on the upstream side of Pune city. Journal NX; c2018. p. 26-31.
6. Standard methods for the examination of water and wastewater. APHA, AWWA and WEF, 21st Edition, 2005.
7. Wagh VM, Ghole VS, Wavde PN, Todkar VV, Kokate KK. Assessment of water quality of Mutha river in Pune city. GCE: Indo-Italian international conference on green and clean environment March 20-21, MAEER's MIT College of Engineering, Pune; c2008.
8. FAO. Water quality for agriculture, irrigation in arid and drainage paper 29, Revised 1. F.A.O. Rome, 174, 1985.