International Journal of Trend in Scientific Research and Development (IJTSRD)
International Open Access Journal
ISSN No: 2456 - 6470 | www.ijtsrd.com | Volume - 1 | Issue – 6

Analysis of Water Quality using Physico-Chemical Parameters of Mula-Mutha River, Pune (Maharashtra)

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ABSTRACT

We want to present an extensive work on physico-chemical parameters of water samples of Mula-Mutha river at Pune (Maharashtra). Water samples under investigations were collected from Khadkwasla dam to Sangam Bridge during pre monsoon (April – May2016) monsoon (July – August2016) and post monsoon (October – November2016) seasons. The observed values of different physico-chemical parameters like pH, DO, BOD, COD, Chloride, Nitrate, Sulphate, Calcium, Magnesium and Hardness, etc. of samples were compared with standard values recommended by world health organization (WHO). The Mula-Mutha River water in Pune had deteriorated in quality. Its biological oxygen demand, an indicator of organic pollution, has risen to over 30 mg/l, more than ten times the permissible limits for bathing. Municipal Corporation is currently supplying water sufficient for the projected population. More water means more sewage, beyond the quantum its sewage treatment plants can treat. As a result there is greater pollution loads discharged in to the Mula-Mutha, two rivers that confluence within city limits and serve to flush away Pune's excreta. All the physico - chemical parameters for pre monsoon, monsoon and post monsoon seasons are within the highest desirable or maximum permissible limit set by WHO except some of the parameters like DO, BOD,COD, chloride, calcium, magnesium and hardness.

Keywords: *Physico-chemical parameters, Municipal Corporation, Mula-Mutha River*

1. INTRODUCTION

Mula –Mutha River was a life line of farmers and residents of Punwadi and its water was used for domestic and agriculture purposes before 1960. Hence, effective maintenance of water quality was required through appropriate measurements. It is a fact that good water quality produces healthier humans than one with poor water quality. Physico-chemical as well as micro-biological characteristics of water can describe the quality of water [20] hence, the analysis on physico-chemical parameters of Mula-Mutha river water was made by many workers. Monitoring at regular intervals of all the parameters is very difficult and laborious task even if adequate manpower and laboratory facilities are available. Therefore, statistical correlation technique can be used for comparison of physico-chemical parameters. The present work deals with the study of 11 physico-chemical parameters like pH, DO, BOD, COD, Chloride, Nitrate, Sulphate, Calcium, Magnesium and total Hardness,etc. The observed values of various physico-chemical parameters of water samples were compared with standard values recommended by World Health Organization [5] (WHO) and are given. The objective is to minimize the complexity and dimensionality of large set of data. Systematic calculation of correlation coefficient between

physico-chemical parameters can be carried out and significant correlation can be further verified [2].

Water quality is a term used to express the suitability of water to sustain various uses or processes. Any particular use will have certain requirements for the physical, chemical or biological characteristics of water; for example limits on the concentrations of toxic substances for drinking water use, or restrictions on temperature and pH ranges for water supporting invertebrate communities [3-4]. Consequently, water quality can be defined by a range of variables which limit water use. Although many uses have some common requirements for certain variables, each use will have its own demands and influences on water quality. Quantity and quality demands of different users will not always be compatible, and the activities of one user may restrict the activities of another, either by demanding water of a quality outside the range required by the other user or by lowering quality during use of the water [5-6]. Efforts to improve or maintain a certain water quality often compromise between the quality and quantity demands of different users. There is increasing recognition that natural ecosystems have a legitimate place in the consideration of options for water quality management. This is both for their intrinsic value and because they are sensitive indicators of changes or deterioration in overall water quality, providing a useful addition to physical, chemical and other information7-9.

Water quality is affected by a wide range of natural and human influences. The most important of the natural influences are geological, hydrological and climatic, since these affect the quantity and the quality of water available. Their influence is generally greatest when available water quantities are low and maximum use must be made of the limited resource[10]. The standards for drinking water quality as well as for the river water are typically set by the Government and by International Standards. The main purpose of this International Body is to maintain the maximum and minimum contaminant levels in the water that is to be used for various purposes. Even the river as well as the natural springs was considered safe for all practical purposes, but now due to increase in industrialization the situation has changed. Hence it is required to analyze the water before using it for various purposes [11-12].

2. EXPERIMENTAL

Water samples were collected from Khadkwasla dam to Sangam Bridge during pre monsoon(April - May), monsoon (July - August) and post monsoon (October - November) phase in year 2016 During sampling pH, was determined using digital pH meter. The laboratory analysis of samples was done using standard methods1 (APHA,1998), titrimetric method was used for the determination of total alkalinity and gravimetric method for total dissolved solid and total suspended solids Mohr's argentometric titration method was used for chloride [27] . Sulphate was estimated using turbidometric method Whereas Ca+2, Mg+2 and TH was determined by EDTA titrimetric method [13]. The entire chemicals used were of AR grade.

Observation Table No. I : Selected Sampling Stations

Sr.No.	Name of the sampling station
1	Kharakwasla (Mutha river)
2	Vitthalwadi (Mutha river)
3	Garware Causeway(Mutha river)
4	Holkar Bridge (Mula river)
5	Wakad Causeway (Mula river)
6	Aundh Causeway (Mula river)
7	Bund Garden (Mula-Mutha river)

Observation Table No. II

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

Parameters	S_1	S_2	S_3	S_4	S_5	S_6	S_7	WHO limit
pH	8.40	6.78	7.73	6.47	6.21	6.10	5.83	6.5 to 8.5
DO	2.3	0.8	0.7	0.8	0.8	0.7	0.6	7 mg/l
BOD	9.51	31	32	53	53	58	63	--
COD	44	87	89	96	102	187	287	--
Chloride	49	118	151	267	263	268	279	250 mg/l
Nitrate	12	26	29	27	36	41	43	50 mg/l
Sulphate	6	8	8.3	19	21	23	29	200 mg/l
Calcium	14	18	21	36	42	49	56	75 mg/l
Magnesium	5	7	9	13	12	26	31	30 mg/l
Hardness	33.12	88.91	113.32	86.23	189	321	304	300 mg/l

Observation Table No III:

Sampling point variation in Monsoon Season (Summer)

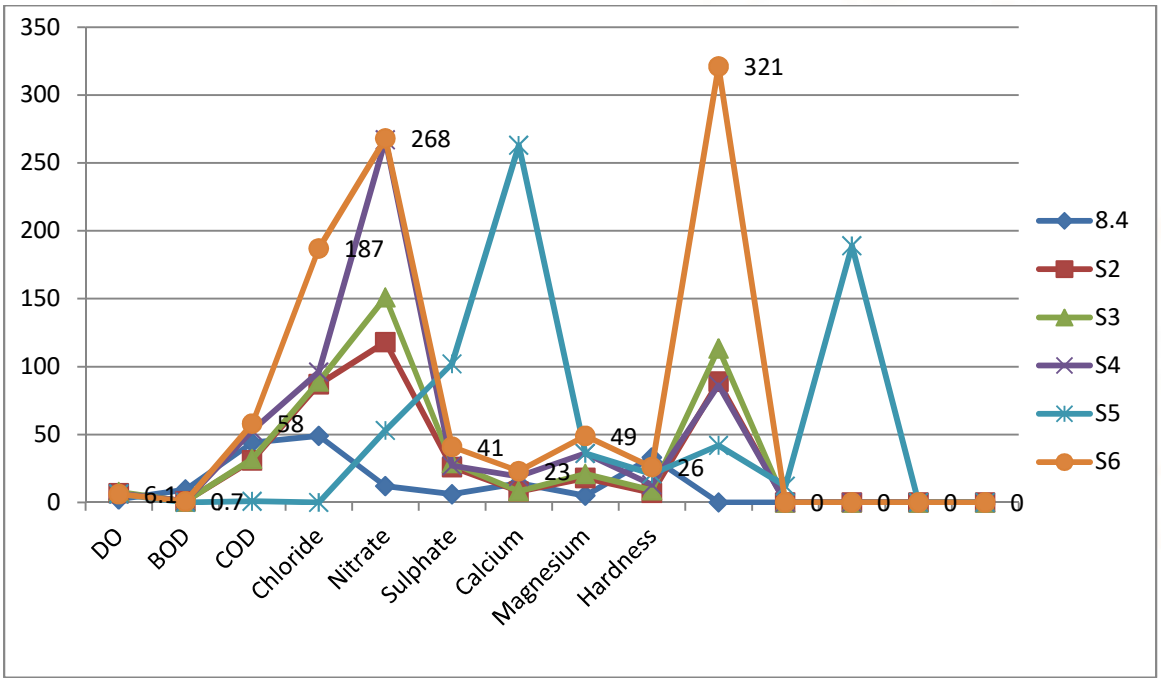
Parameters	S_1	S_2	S_3	S_4	S_5	S_6	S_7	WHO limit
pH	9.51	8.23	7.72	6.65	7.32	6.31	5.67	6.5 to 8.5
DO	2.41	0.91	0.78	0.65	0.79	0.83	0.63	7 mg/l
BOD	10	46	43	48	53	56	69	--
COD	46	44	63	83	123	136	143	--
Chloride	29	65	217	231	236	248	259	250 mg/l
Nitrate	13	17	18	21	19	26	36	50 mg/l
Sulphate	16	21	27	29	31	37	46	200 mg/l
Calcium	21	33	39	48	47	53	68	75 mg/l
Magnesium	9	14	16	15	18	24	28	30 mg/l
Hardness	23	123.21	128	143.23	163	198	207	300 mg/l

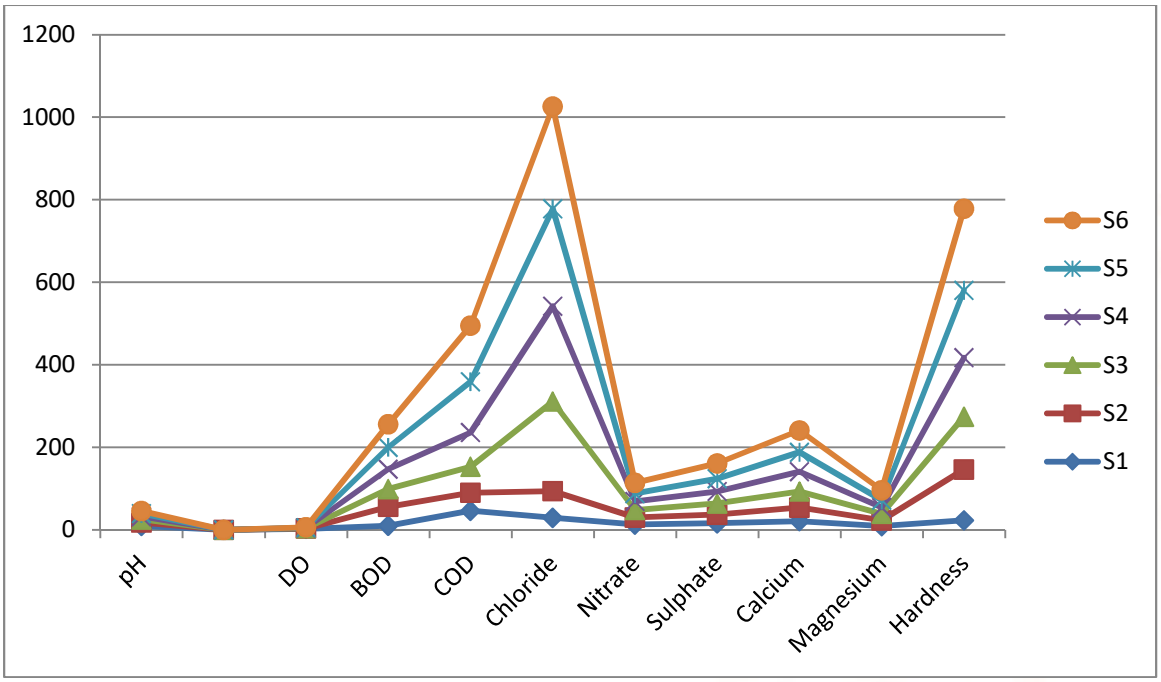
Observation Table No IV:

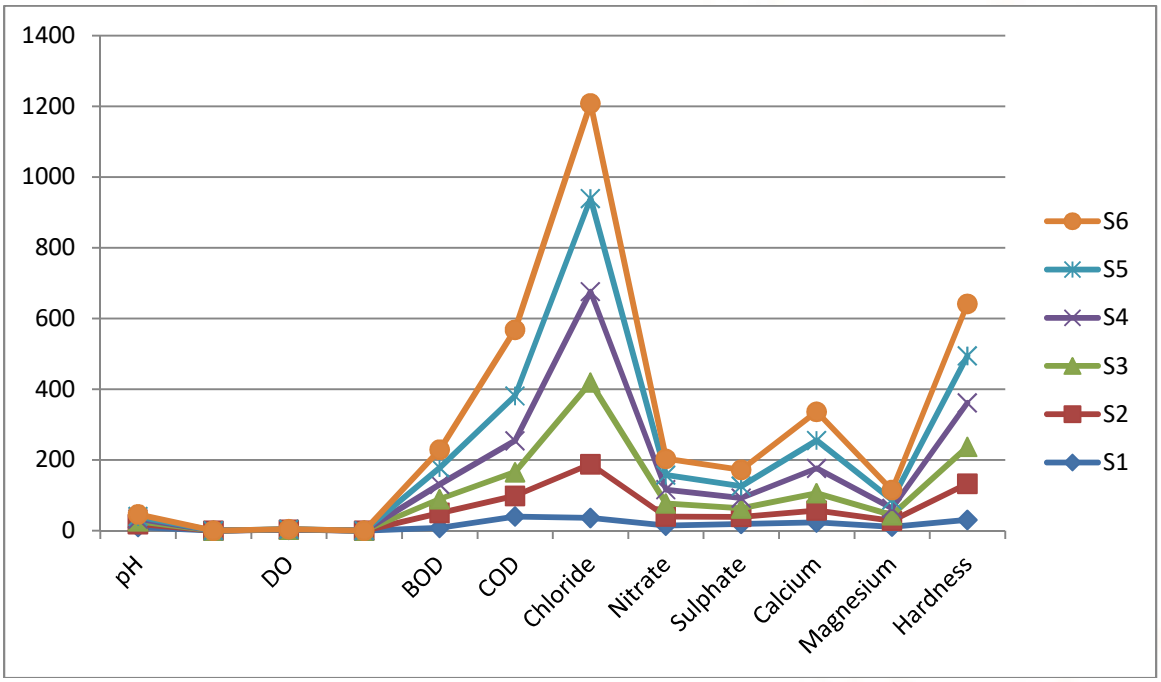
Sampling Point variation in Post Monsoon Season (Winter)

Parameters	S_1	S_2	S_3	S_4	S_5	S_6	S_7	WHO limit
pH	9.89	8.64	7.97	6.83	6.67	6.12	5.68	6.5 to 8.5
DO	2.1	0.7	0.6	0.3	0.23	0.19	0.12	7 mg/l
BOD	08	42	39	42	47	51	67	----
COD	40	58	67	89	127	187	201	----
Chloride	36	152	231	257	263	269	273	250 mg/l
Nitrate	14	26	37	39	41	46	49	50 mg/l
Sulphate	19	20	24	29	34	46	57	200 mg/l
Calcium	23	34	49	70	79	81	87	75 mg/l
Magnesium	11	17	16	19	24	28	29	30 mg/l
Hardness	30.16	102.44	104.68	124.04	133	147	168	300 mg/l

Graphical presentation of the physic-chemical parameters:







3. RESULTS AND DISCUSSIONS

There is a large range of water quality parameters which can be used to characterize waters. However, some parameters are of special importance and deserve frequent attention. Further, depending upon the objective of characterization of a water body, different suits of parameters may be selected. The water parameters can be determined by both analytically i.e. in laboratory and also in the field while collecting the water sample, and hence the parameters which can be determined in the field are called as the field-parameters. Water samples were collected from Khadkwasla dam to Sangam Bridge during pre monsoon (April - May), monsoon (July - August) and post monsoon (October - November) phase in year 2016.

pH is defined as the logarithmic of reciprocal of H+ ion concentration. When hydrogen ion concentration increases, water becomes acidic and pH value reduces. pH measurements are important in medicine, biology, chemistry, agriculture, forestry, food science, environmental science, oceanography, civil engineering, chemical engineering water treatment & water purification plants and many other applications

[14]. Here pH is observed in the range from 8.40 to 5.83 at pre-monsoon season which shows that water is alkaline at first sampling station i.e. Kharakwasla and 5.83 at the sampling station Bund Garden, which shows water is acidic, means H+ ion concentration is increased. But at Monsoon pH is in the range of 5.67 to 9.51 which shows alkalinity at first sampling station, it may be due to collection of water by all the sources. At post Monsoon pH is in the range of 5.68 to 9.89 which proves that water is alkaline at first sampling station.

Dissolved oxygen is a relative measure of the amount of oxygen which is dissolved or carried in a water body. Dissolved oxygen levels are depending upon the physical, chemical, and biochemical activities prevailing in the water body. Here the observed values are in the range of 0.6 to 2.41 mg/L at all the season. Dissolved oxygen is important for living organism to mentain their biological processes[15-16]. In corrosion also it is important factor. The higher concentrations of DO in winter were probably due to the fact hot conditions during winter are more favorable for higher photosynthesis[17]. Good water should have the solubility of oxygen. 7.6 and 7.0 mg/L at 30oC and 35oC respectively[18-19]. Dissolved Oxygen in water is necessary for aerobic biological activities. In the absence of sufficient amount of dissolved oxygen in water, the anaerobic degradation of the pollutants makes the water foul smelling.

BOD is a measure of the amount of oxygen required for the Biological Oxidation of the organic matter under aerobic conditions at 20 0c and for a period of 5 Days. Basically BOD is directly related to the extent of pollution of waste water, sewage and industrial effluents[20-21]. Here observed values are in the range of 08 to 69 mg/L. Here, the higher value of BOD observed is 69mg/L, at Moonson session at Bund Garden sampling station. COD is a measure of any kind of oxidisable impurities present in the sewage[22]. COD is a measure of both the biologically oxidisable and biologically inert organic matter present in the sewage sample[23]. Here observed values are between 44 to 287 mg/L.

Chlorides are present in all natural waters. Fresh water sources contain chlorides ranging from 100 to 200 mg/L[24, 26]. Here, observed values are in the range of 29 to 279mg/L. Higher values of chlorine indicates the use of water for bathing, washing clothes, use of detergents, etc. The amounts of chloride found in the sample did not exceed the maximum permissible limit i.e. 500 mg/L for drinking water prescribed by WHO[28]. The presence of sulphate has less effect on the taste of water compared to the presence of chloride[25]. The desirable limit of sulphate in drinking water prescribed by ICMR is 200-400 mg/L. For the remaining parameters like calcium magnesium and hardness, the observed values are within the limit of WHO[28].

4. CONCLUSION

It is concluded that the physic-chemical parameters of Mula-Mutha river are within the permissible limit prescribed by WHO except some of the sampling stations for two-three parameters, like chlorides and hardness at pre-monsoon stage. BOD and COD at post monsoon stage. 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.

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