Status Of Water Quality Index In Harsul Lake At Aurangabad; A Case Study

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Abstract:

In the present study, the analysis of water samples collected from Harsul lake in Aurangabad, Maharashtra was observed to know the status weather the water is suitable for drinking or for domestic purpose.It is found that this lake as a perennial source to meet the ever-increasing demands for freshwater by the Aurangabad which, requires short-term as well as long-term remedial measures. Short-term measures should involve periodic cleaning of the S_3 and S_4 site popularization of eco-friendly waste disposal programs and development of alternative closed system technology. Long-term measures should involve steps to increase the water retaining capacity of the riverine by promoting afforestation, construction of tanks and ponds for rainwater harvesting and proper maintenance of existing once and construction of sub-surface Proper water quality management practices may help to achieve the conservation of the lake as well as sustained ecosystem. Studies also reveals that water of the area is very hard and highly alkaline which is dominated by bicarbonate anion with calcium magnesium cations. The overall picture that emerges out of the present study warrants certain remedial measures for the conservation and sustainable management of Harsul lakeecosystem and for drinking water, it should be properly treated before releasing for drinking purpose.

Key Words: *Water Quality Index (WQI), Harsul Lake and Physico-chemical Parameters.*

1. Introduction

Since the quality of water affects our lives in many ways water must be of good quality for healthy survival of organisms. Water quality has a great influence on the ability of aquatic plants and animals to exist and grow in stream, lake, pond or river for this chemical method can be applied to measure concentration of pollutants. Most of our known water resources are threatened due to over exploitation. The study area of Aurangabad is recognised as the fastest growing industrial city in Asia with industries spread over different parts. The city is one of the major industrial centres in central Maharashtra. The variety of Industrial centres located includes five stars at Shendra, Chikalthana, Waluj, Pandharpur and Paithan MIDC area,these industries have providedgrowth opportunity. Since the water contents dissolved and suspended consequence in varying proportion, it often has different chemical and physical property. The rate of aquatic bacteria as coined much later in the historical era.

Study Area:Aurangabad is located on the banks of the River Kham; the entire city is situated at the latitude of 19053‘50‘‘N and longitude of 750 22‘46‘‘E**.** In terms of water quality parameters, the comparison between first stations to fourth station of the lake of Harsul may provide valuable information on anthropological activities going around the main township. The area falls in Jatwada of upper mountain. The middle and upper Jatawada and the recent deposits constitute the main georgical formations. It consists of conglomerate friable micaceous sandstone, siltstone, and claystone. The recent deposit includes alluvial fans and terraces o unasserted sand, slit, clay and rock fragment and boulder beds. The conglomerates are in general poorly cemented but some places they are very hard. These consist mainly of pebbles and cobbles of quartzite.

The Jatwada hill represents layered sequence of sandy rock deposited in the plain of area. Recent deposits occupy and comprise sand, slit and clay in varying proportion and support cultivation. The water table in the area generally varies from 30 -50m below the ground level. There are no industrial units in the area posing threat to ground water sources. The main natural recharge to the ground water is rom precipitation and influent seepage from streams during rainy seasons with maximum contribution from rainfall. Rainfall influences the yield and water quality to great extent. It is, therefore of utmost importance that a lean period discharge and water quality of a spring is very precisely assessed before the final decision is arrived at to select the spring as source of water supply to a community.As there is dearth of literature of water quality about this area, the present study was undertaken to assess the exact level of physico-chemicals parameters with water quality index of the Harsul lake, being used for water supply schemes in Aurangabad city area with special reference to sustainability of water for drinking purpose.Such a source is not depended upon as a source of potable water supply, unless a thorough and frequently investigation is carried out, with respect to its physical bacteriological quality. The required provision should be made to improve its quality by deciding of filtration, disinfection, or any required corrective measure. Many researchers have focus on river and lake pollution *i. e.*Adeyemo, et.al, 2008; Chavan, and Thorat, 2004; Ganpat More et. al., 2019; Harshad Kakadeand Thorat., 2017; Jogi, et. al., 2012 and Jogi et. al., 2013.

2. Material And Methods

Field visit and sample collections: Water samples were collected from the Harsul lake sites for all three seasons from February 2019 to January 2020. The sample was collected in morning session from 7.30am to 11am. Samples for physicochemical analysis were collected directly from the surface of water with the help of 2-literacid cleaned polythene bottles. These water samples were kept in darkness in iceboxes at 4^0C till the samples reached the laboratory for analysis.(Rexhepi andRugova, 2010 and Salman,2006).

Collection of water samples for BOD: The samples for BOD analysis were collected from surface (1-2cm) in separate BOD bottles. Two such bottles were used for each sample. One was fixed on the spot immediately after the collection following Winkler method and the second bottle containing water was kept in darkness at 4 ^{0}C (in iceboxes) till it reached the laboratory. (Kodarkar, 1992; Murugesan, and Rajkumari, 2006).

Field measurements: Air and water temperature were measured using a glass thermometer; pH, dissolved oxygen (DO), electric conductivity(EC), total dissolved solids (TDS) of water samples were measured on the spot using a portable water and soil analysis kit. EC and pH were also measured using separate pocket testers. All the data were recorded in separate field books. The samples for DO were fixed on the spot using Winkler iodometric method (NEERI, 1988.).

All chemical used in this study were of an analytical grade. Deionized distilled water was used for estimation and reagent preparation. Amber glass bottles with polyproline cap were used for collection of water for each sampling sites. Water samples were collected separately from each of the four-sampling station of Harsul lake. Total conductivity, pH, TDS and DO were measured at collection site by water analyzer kit, *Elico,* India. Ca hardness indicates tablets were used for the estimation of Ca hardness. Spectrophotometric estimation was preserved and analyzed with other parameter in accordance with standard method (APHA, 1995 and Ramakrishnan, 2010).

Calculation for Water Quality Index: WQI is defined as the composite influence of different water quality parameters in the quality of water. Total 11 parameters were selected to calculate water quality index of the above-mentioned rivers. The parameters are enumerated in 1 to 3. The calculations for WQI are as follows.

WQI=anti log En=1-12Wn log q_n.....(1)

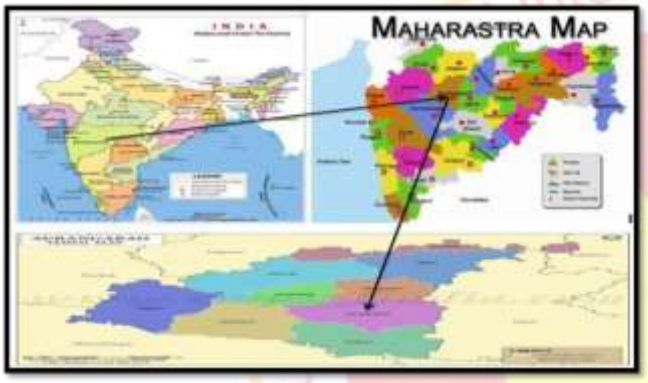
Where Wn=k/Sn: Wn=unit weight for the nth parameters: Sn= (n= 1, 2, 3-----12) refers to water quality parameters; K= constant of proportionality for the sake of simplicity we assume k=1; qn=quality rating of nth water quality parameter. The quality rating (qi) for with water quality parameters may be obtained for all parameters except pH and D.O. by the relation (Ramakrishnan, 2010).

Qi=100(Vi/Si)…….(ii)

Where Vi= observed value: Si= recommended standard value for the ith parameter.
Equation (ii) ensures that qi=0, when a pollutant (that is the ith parameter) is absent in the water, while qi=100, if the observed value of this parameter is just equal to its permissible value (or standard) for drinking water.

The Water Quality Indices as calculated and presented in Table 1-3, whereas the standard WQI and Permissible limit and quality of water in all three seasons is quoted Table 4 and 5 respectively.

FIG 1: SHOWING LOCATION MAPOF AURANGABAD INMAHARASHTRA



3. Results And Discussion

Water quality is a broad term and can be interpreted in different ways according to its intended usedrinking, irrigation, industries, power generation and recreation. Presumably, the variation in the water quality requirement among users does not allow it to get grouped under common standards.Therefore, based on their use and quality demand, water sources are classified into five major types. All the important physico-chemical parameters such as pH, Electrical conductivity, Total dissolved solids, Alkalinity, Total Hardness, Total Suspended solids, Calcium, Magnesium, Chlorides, Dissolved oxygen and BOD are monitored with the view of understanding the pollution loads as well as to evaluate the trends of these loads in the surface water bodies in order to formulate management plans accordingly The different constituents of water samples are given in Table 1 Showing drinking water standards recommending agencies and unit weights and the result have been compared with Indian Standard specification for drinking Water (IS:10500-91). Water quality index of the present water body is established from important various physico-chemical parameters for calculation of water quality index are presented in tables 1, 2 and 3. from the study of all the sites in every season. The study indicates the poor quality of water, this water quality rating study clearly shows that, the status of the water body in S_2 and S_3 site was eutrophic and it is unsuitable for the uses. It is also observed that the pollution load is relatively high during summer season when compared to the winter and rainy season.

The above water quality is also supported by the following physico chemical parameters variations observed during the different seasons of the study. Among all the physico chemical parameters selected for the water quality index calculations are by various workers in khandesh region and have paid their attention on water quality of river Girna and Tapi and river Waghur. (Chaudhari, et. al., 2013; Chavan, et. al., 2018; Gaikwad and Thorat. 2006; Sheejan and Thorat, 2013; Sheejan and Thorat, 2016; Sheejan et. al., 2012; Tukaram,et. al., (A)2018 and Tukaram, et. al., (B.)2018). The result obtain from the study is given in table 1 to 3. Water pollution is an acute problem in all the major rivers of India**.** In the wake of increasing urbanization and industrialization, the pollution potential of Harsul dam is gaining momentum day by day. The survey of lake revealed that villages and towns which fall in the way of dam, dump solid waste and toxic wastes in the lake. This has caused serve pollution in the lake water to the extent that its water is no more palpable and is posing threat to the survival of aquatic flora and fauna. The study also helps in formulating remedial measures. Based on this, the Harsul lake comes into the category of cleaner dam and its water is fit for city water supply after normal treatment. Growing urbanization around this is likely to degrade water quality. It could be a threat to public health in future years since these water bodies makes an important source of drinking water for Aurangabad city, respectively. So,on the basis of present study, we proposed few suggestions with the end to monitor pollution and reduce water quality index (WQI) of this Harsul lake is not to a much safer level (S_2 and S_3). Proper treatment of water (biological and chemical) is required to be done before human consumption. Many workers have given their contribution towards river water quality assessment and the similar results obtained from the

following investigators,*i.e.*Chavan and Thorat, 2012; Chavan and Sanjaykumar, 2013; Chavan, et. al., 2013; Olubunmi and Oolorunsola, 2010; Pastorinho, et. al., 2010; Plathe, 2010 and Praveena et. al., 2007.

Table 1: Showing Water Quality Index for Site- S_1 to S_4 Sites of Harsul Lake in Summer Season from Feb. 2019 To Jan. 2020.

Sr. No.	Parameter	Observed Value Vn	Standard Value Sn	Unit weight Wn	Quality rating qn	Wnqn
1	pH	6.5	8.5	0.2190	92.85	24.40
2	Electrical conductivity	144	300	0.371	48	17.80
3	Total dissolved solids	100	500	0.0037	20	0.07
4	Alkalinity	69.9	120	0.0155	58.25	9.02
5	Total Hardness	67.8	300	0.0062	22.6	0.14
6	Total Suspended solids	42	500	0.0037	8.4	0.03
7	Calcium	25	75	0.025	33.33	0.83
8	Magnesium	52	30	0.061	173.33	10.57
9	Chlorides	98	250	0.0074	39.2	0.29
10	Dissolved oxygen	8.2	5.0	0.3723	164	61.05
11	BOD	2.1	5.0	0..3723	42	1.14
ΣWn=1.25 Σqn=720.54 ΣWnqn=125.38						
Water quality index = ΣqnWn/ΣWn= 100.18						

Table 2: Showing Water Quality Index for Site- S_1 to S_4 Sites of Harsul Lake in Rainy Season from Feb. 2019 To Jan. 2020.

Sr. No.	Parameter	Observed Value Vn	Standard Value Sn	Unit weight Wn	Quality rating qn	Wnqn
1	pH	8	8.5	0.2190	114.28	25.02
2	Electrical conductivity	147.5	300	0.371	49.16	18.24
3	Total dissolved solids	74.2	500	0.0037	14.84	0.05
4	Alkalinity	46.8	120	0.0155	39	6.04
5	Total Hardness	110	300	0.0062	36.66	0.22
6	Total Suspended solids	60	500	0.0037	12	0.04
7	Calcium	40.3	75	0.025	53.73	1.34
8	Magnesium	36.1	30	0.061	120.33	7.34
9	Chlorides	25	250	0.0074	10	0.07
10	Dissolved oxygen	9.9	5.0	0.3723	198	73.71
11	BOD	2.8	5.0	0..3723	56	1.52
ΣWn=1.25 Σqn=704.02 ΣWnqn=133.63						
Water quality index = ΣqnWn/ΣWn= 106.78						

Table 3: Showing Water Quality Index for Site- S_1 to S_4 Sites of Harsul Lake in Winter Season from Feb. 2019 To Jan. 2020.

Sr. No.	Parameter	Observed Value Vn	Standard Value Sn	Unit weight Wn	Quality rating qn	Wnqn
1	pH	7.4	8.5	0.2190	105.71	23.15
2	Electrical conductivity	135.0	300	0.371	45	16.69
3	Total dissolved solids	116.0	500	0.0037	23.2	0.85
4	Alkalinity	36.4	120	0.0155	30.33	4.70
5	Total Hardness	82.6	300	0.0062	27.53	0.17
6	Total Suspended solids	67.4	500	0.0037	13.48	0.04
7	Calcium	20.2	75	0.025	26.93	0.67
8	Magnesium	62.4	30	0.061	208	12.68

9	Chlorides	25.2	250	0.0074	10.32	0.07
10	Dissolved oxygen	9.6	5.0	0.3723	192	71.48
11	BOD	2.1	5.0	0..3723	42	1.14
ΣWn=1.25 Σqn=724.51 ΣWnqn=130.91						
Water quality index = ΣqnWn/ΣWn= 104.60						

Table 4: Showing Water Quality Index for Harsul Lake in Summer, Winter and Rainy Season From Feb. 2019 To Jan. 2020.

Sr. No.	Location	Water Quality Index (WQI)	Status
1.	Sites of upstream towards Harsul dam S_1, S_2, S_3 and S_4.	Summer Season 100.18	Moderate quality
2.	Sites of downstream towards Harsul dam S_1, S_2, S_3 and S_4.	Winter Season 106.78	Unsuitable for drinking
3.	Sites of stagnant zone backwater in Harsul dam S_1, S_2, S_3 and S_4.	Rainy Season 104.60	Unsuitable for drinking

Table 5: Showing Drinking Water Standards Recommending Agencies and Unit Weights. (All Values Except Ph And Electrical Conductivity Are In Mg/L.)

Sr. No.	Parameters	Standards	Recommended Agency	Unit Weights
1	pH	6.5-8.5	ICMR/BIS	0.2190
2	Electrical conductivity	300	ICMR	0.371
3	Total dissolved solids	500	ICMR/BIS	0.0037
4	Alkalinity	120	ICMR	0.0155
5	Total Hardness	300	ICMR/BIS	0.0062
6	Total Suspended solids	500	WHO	0.0037
7	Calcium	75	ICMR/BIS	0.025
8	Magnesium	30	ICMR/BIS	0.061
9	Chlorides	250	ICMR	0.0074
10	Dissolved oxygen	5.00	ICMR/BIS	0.3723
11	BOD	5.00	ICMR	0..3723

4. Conclusions

In general, water quality characteristics studied were not within the limits for any site standard values prescribed by various agencies S_2 and S_3 sites of the lake in all season's shows high BOD and COD values. During summer period indicate the contamination of river water by erogenous organic matter as well as anthropogenic activities. Proper water quality management practices may help achieve the conservation of the river as well as sustained ecosystem. The results indicated that there is no major pollution hazard in the Harsul lake water which is situated in Aurangabad city area as the MPN Count of coliform in the water samples has been found to be zero whereas, water in the area is highly alkaline and is very hard. The chloride, iron and fluoride contents in the lake water of the area are low. As per drinking water is concern, water should be properly treated before releasing to drinking purpose in Aurangabad city area.

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