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Preliminary Assessment on Water Quality of Kolar River with Physico Chemical Analysis

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Abstract: River water quality is very essential as it is used for drinking and domestic purposes. For the public health safety it is necessary to check the pollution level in the water bodies. The study was conducted to assess the water quality of Kolar River (A right bank tributary of wholly Narmada River). During the present study a number of physiochemical parameters including Temperature, pH, EC, TDS, DO and Chloride, were measured on field, so that the accuracy of the result will be appropriate while as Nitrate and Phosphate were measured in the lab. The water samples were collected in plastic container of 500 ml capacity from eight (8) different selective sampling stations along the Kolar River. The mean value of such respective parameters compared with the water quality standards as set by the WHO and BIS.

Key Words: Water quality, Kolar River, Physiochemical, Assessment

Introduction

Water is called Universal Solvent necessary for human civilization, living organisms and natural ecosystems. It is used for drinking, industry, agriculture, transportation, recreation and for producing electricity for domestic, commercial and industrial use. Water is the most important and basic resource on the planet. The physical features of earth determine the direction of flow of water. In such a geographical unit where water gets regularly and seasonally, weathering of rocks, soil condition and other climatic factors along with availability of water support the growth and development of plant communities. The quality of water resources is a subject of ongoing concern. The health and happiness of the human race are closely tied up with the quality of the water used for consumption where the per capita consumption of water is an index of quality of life of the people as well as their economic and social condition. It is being estimated that by the year 2025 more than half of the world population will be facing water-based vulnerability (Kulshreshtha, 1998). River water pollution has become severe problem in all countries. Major reasons of pollution are industrial release and sewage discharge directly into water bodies without proper treatment. They count for pollution of approx 70% of total available water (Dhirendra *et al*., 2009). Water supply system has been polluted by heavy chemicals, metals, salts and harmful microbes (Onwughara *et al*., 2013). Water pollution is real threat to the nature because changes in the water quality in polluted aquatic ecosystem destroy biotic community present within ecosystem. Contamination of water leads to countless health hazardous effects to human as it cause infection of water born disease (Sharma *et al*., 1996). Hence pollution of fresh water bodies is great concern in all countries. Therefore the drinking water quality

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should be necessarily analyzed at regular intervals. The utility of river water for various purposes is governed by physico-chemical and biological quality of the water. The assessment of the changes in river communities as a result of the impact of pollution is particularly interesting issue within the frame work of aquatic ecology, since running waters are becoming increasingly affected by anthropogenic discharge. Quality of water is defined in terms of its physical, chemical and biological parameters (Almeida, 2007). Water quality index allows for a general analysis of water quality on many levels that affect a stream's ability to host life and whether the overall quality of water bodies poses a potential threat to various uses of water (Akkaraboyina and Raju, 2012).

Study area

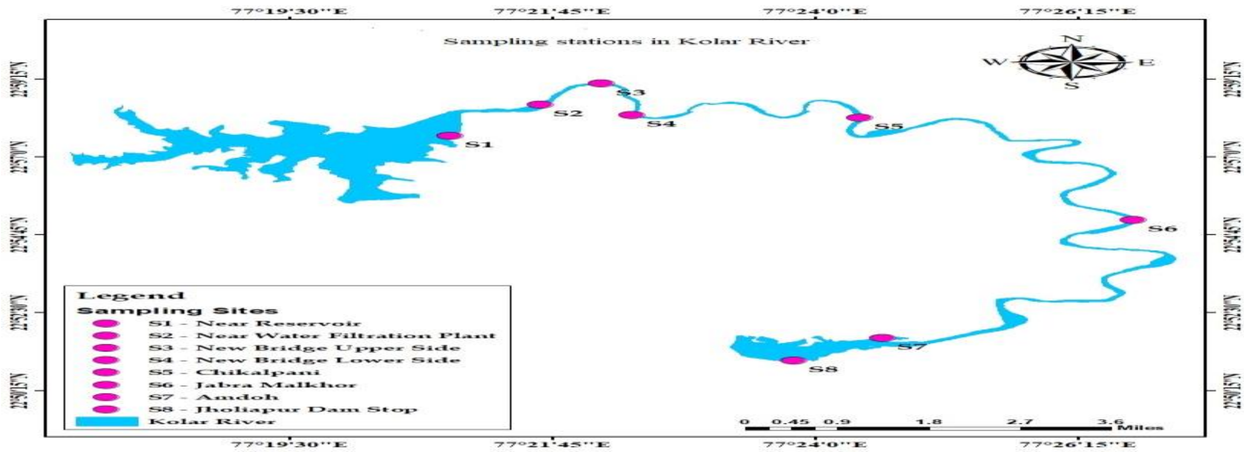
Narmada River is one of the only three major rivers in peninsular India. It flows westwards over a length of 1312km after draining through the Gulf of Cambay entering into the Arabian Sea. Kolar River is a right bank tributary of the Narmada River which flows for a total length of 101 km (63 mi) all of which is in the state of MP. It is located at $21^0 14'$N $79^0 10'$E.

The study was conducted between the stretches of about 101km which was divided into 8 sampling stations namely Near Reservoir (Station-1), Water Filtration Plant (Station-2), New Bridge Upper side (Station-3), New Bridge Lower side (Station-4), Chikalpani (Station-5), Jabra Malkhor (Station-6), Amdoh (Station-7) and Jholiapur dam stop (Station-8) of the Kolar River.

Table 1: Showing sampling stations at Kolar River

S. No.	Sampling Stations	Station Name	Latitude and longitude
1	**Station-1**	Near Reservoir	$22^0 57'36.84"$**N** $77^0 20'52.30"$**E**
2	**Station-2**	Water Filtration Plant	$22^0 58' 30.9"$**N** $77^0 21'38.4"$**E**
3	**Station-3**	New Bridge upperside	$22^0 59' 7.07"$**N** $77^0 22'10.3"$**E**
4	**Station-4**	New Bridge lowerside	$22^0 58'12.5"$ **N** $77^0 22'26.01"$**E**
5	**Station-5**	Chikalpani	$22^0 58' 8.21"$**N** $77^0 24'22.8"$**E**
6	**Station-6**	Jabra Malkhor	$22^0 55'10.8"$**N** $77^0 26' 42.9"$**E**
7	**Station-7**	Amdoh	$22^0 51'46.5"$ **N** $77^0 24'34.3"$**E**
8	**Station-8**	Jholiapur Dam Stop	$22^0 51'7.35"$**N** $77^0 23' 48.8"$**E**

Map-1: Showing sampling stations at Kolar River



Methodology

The whole methodology for study of physicochemical analysis is followed from American Public Health Association (APHA, 1998) and Workbook on Limnology (Adoni *et al.*, 1985). The statistical analysis was carried out by using SPSS *ver.* 20 and PAST software. In figure A=S1, B=S2, C=S3, D=S4, E=S5, F=S6, G=S7 and H=S8

Results and Discussions

Temperature

The temperatures of the Kolar River water fluctuated in the study area ranged from 20.7^{0}C to 24.9^{0}C. The minimum water temperature was recorded at sampling Station-2 and maximum was recorded at sampling station-3 (Table 2 Fig 1). Similar observations were recorded by Afrin *et al.* (2015) worked on Turag River and observed water temperature values ranged from 23.20^{0}C to 31.90^{0}C. The study on river Ami reveals that the temperature fluctuated between 20^{0}C to 32^{0}C and 23^{0}C to 31^{0}C in upstream and downstream stations respectively (Singh and Singh, 2003). In the present investigation the atmospheric temperature was also recorded which was ranged from 26.5^{0}C to 28.9^{0}C. The minimum water temperature was recorded at sampling Station-7 and maximum was recorded at sampling station-3 (Table 2 Fig 2). The present observations are in conformity with the finding of the work of (Sharma and Jain, 2000); Chaturbhuj *et al.* (2004); Bhaumik *et al.* (2005) and Arya *et al.* (2011) on reservoirs, rivers, wetlands and ponds. Water temperature controls metabolic activities and growth rate in organisms and hence it is considered as one of the significant limiting factors in aquatic ecosystem (Dheer, 1988).

Dissolved oxygen

Dissolved oxygen is an important parameter to assess water quality of any aquatic ecosystem as it reflects the biological and physical process existing there in (Trivedi and Goel, 1984). Sufficient oxygen is necessary for the survival of aquatic fauna and for decomposition of organic matter by microorganisms (Islam and Meghla, 2010). A stream must have a minimum of about 2mgl^{-1} of dissolved oxygen to maintain higher life forms Shivayogimath *et al.* (2012).

During the present investigation the levels of dissolved oxygen of the Kolar river water samples ranged from 7mgl^{-1} to 12.8mgl^{-1}. The minimum dissolved oxygen was recorded at Station-1 and Station-4 while as the maximum was recorded at Station-6 for Kolar river water samples respectively (Table 2 Fig 6). Dissolved oxygen was recorded higher due to the presence of aquatic flora as well as riparian vegetation along the buffer zone of Kolar River. The results are with the conformity of Toriman *et al.* (2018), who worked on Nerus River in (Malaysia) and recorded dissolved oxygen values between 4.88mgl^{-1}-7.59mgl^{-1}. Magadum *et al.* (2017) reported dissolved oxygen variations from 6.0mgl^{-1} to 11.3mgl^{-1}. It is evident that Kolar River had dissolved oxygen concentrations well within the maximum permissible limit 6.0-8.5 of BIS (2012) throughout the study period.

Electrical conductivity

Electrical conductivity is a measure that accounts for dissolved solids into the water a high level of conductivity in the stream is indicative of possible sources of dissolved ions in nearby areas and thus considered an important parameter to locate areas exhibiting water quality problems (Vishali and Punita, 2013). The Station wise variations of Electrical Conductivity ranged from 119µScm^{-1} to 485µScm^{-1} for Kolar river water samples. The highest value of Electrical conductivity 485µScm^{-1} was recorded at sampling Station-3 (Table 2 Fig 4). The Electrical Conductivity values are within the permissible limits. Similar observations were made by Pandey *et al.* (2015) worked on Kalyadeh stream and found conductivity ranged between 370 µScm^{-1} to 460 µScm^{-1}. All the Stations exhibited electrical conductivity well within the permissible limit 500 µScm^{-1} of BIS (2012).

pH

pH is a measure of hydrogen ion activity in moles per liter, which can determine the acid–base equilibrium of dissolved components. The Station wise variations of pH were ranged from 7mgl^{-1} to 8.5mgl^{-1} for Kolar River water samples respectively (Table 2 Fig 3). Healthy flora in the catchment area helps and maintains the pH of the Kolar River. The results are in conformity with the (Rahman *et al.*, 2021) who reported the pH values varied from 6.11 to 8.37 for Turang River in Bangladesh. Chandra *et al.* (2011) also recorded pH values 6.78 to 7.87 during their study in Ganga and Hoogli River in India. pH less than 6.5 or greater than 9.2 would markedly impair the potability of the water (WHO, 2008). Higher values of pH hasten the scale formation in water heating apparatus and reduce the germicidal potential of chlorine (Trivedy and Goel, 1986).

The results of pH of water in the Kolar River covered under the present study revealed that majority of river Stations showed alkaline nature. Similar remark was made by Baruah *et al.* (2008) and Simpi *et al.* (2011) in different rivers of fresh water. The present study of pH was recorded 7 to 8.5 this observation is in accordance with Deshkar *et al.* (2014). Values of pH throughout the study period were found to be within the permissible limits 6.5-8.5 prescribed by BIS (2012).

Total dissolved Solids

TDS are composed of carbonates, bicarbonates, chlorides, sulphates, phosphates and nitrates of sodium, potassium, calcium and manganese Sudarshan *et al.* (1991); Bhattacharjee *et al.* (2010). The Station wise variations of TDS were ranged from 57mgl^{-1} to 445mgl^{-1}. The minimum TDS was recorded at Station-5 and maximum was recorded at Station-3 for river water samples respectively (Table 2 Fig 5). Less human interferences and less agricultural activities along the Kolar River catchment are responsible for less TDS levels in Kolar River. Similar remarks were made by Aktar *et al*. (2017) who worked on Turag River and observed TDS ranged from 167mgl^{-1} to 435mgl^{-1}. Moniruzzaman *et al.* (2009) 582 mgl^{-1} to 655mgl^{-1} and Kumari *et al.* (2013) in Narmada River 136mgl^{-1} to 360mgl^{-1}. Simpi *et al.* (2011) during their study analysis of water quality using physico- chemical parameters in Shimoga District, Karnataka, India and found TDS values between 120mgl^{-1} to 256.4mgl^{-1} and made similar remark with the present study.

During the whole study Total dissolved solids at all Stations were found below the maximum permissible limit 500 ppm of BIS (2012).

Chloride

Chloride is an anion, which occur naturally in all natural waters, chlorine as such is non toxic to human beings but its elevated levels can be considered as the “advance warning” of the existence of other toxic contaminants in water (Kelly *et al.*, 2012).

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The Station wise variations of chloride were ranged from 10.99mgl^{-1} to 198mgl^{-1}. The minimum range was recorded at Station-3 and maximum was recorded at Station-6 for river water samples respectively (Table 2 Fig 7). The sources of chloride in the catchment of Kolar River were due to the runoff containing inorganic fertilizers, animal feeds and irrigation drainage. Similar observations were made by (Islam *et al.,* 2018), the Cl^{-} concentration of the Turag River surface water ranged from 80.74mgl^{-1}to 137.3mgl^{-1}. Kumar *et al.* (2014) reported the value of chloride ranged between 18mgl^{-1} to 55mgl^{-1} during their work on assessment of water quality of Cauvery River.

During whole study, Chlorine values at all the Stations were well below the maximum permissible limit 250mgl^{-1} of BIS (2012).

Nitrate (NO_3-N)

Nitrate containing compounds act as nutrient in the streams. Waste water discharges consist of domestic wastes, sewage, effluents from industrial setup, urban runoff combined with agricultural runoff which may also include fertilizers, are the major threats in terms of nutrient pollution (Dubey *et al.,* 2012).

The NO_3 -N values in the present study ranged from 0.189mgl^{-1} to 3mgl^{-1}. The minimum was recorded at Station-3 and maximum was recorded at Station-1 for river water samples respectively (Table 2 Fig 8). Lower levels are the results of good forest and vegetation cover in the study area of Kolar River. Similar results were reported by (Nnaji *et al.,* 2010) and observed Nitrate value between 1.6mgl^{-1} to 2.4mgl^{-1} in River Galma.

Nitrates in conjunction with phosphorus stimulate the growth of algae with all of the related problems associated with excessive algae growth. According to WHO (2008) maximum acceptable limit of nitrate for drinking purpose is 50mgl^{-1} and BIS (2012) recommended limit is 45mgl^{-1}.

During whole study, Nitrate values at all the Stations were well below the maximum permissible limit 45mgl^{-1} of BIS (2012).

Orthophosphate

In natural waters phosphate generally occurs low to moderate concentrations. Major sources of phosphate are agricultural runoff containing phosphate fertilizers containing phosphate fertilizers as well as the waste water containing detergents (Naseema *et al.*, 2013).

Orthophosphate in the present study ranged from 0.129mgl^{-1} to 1.329mgl^{-1}. The minimum orthophosphate was recorded at Station-1 during and the maximum was recorded at Station-6 for river water samples respectively (Table 2 Fig 9). Bisht *et al.* (2005) reported the phosphate value in the range of 0.36mgl^{-1} to 2.38mgl^{-1} during their investigation of physico chemical properties of some sub-tropical water bodies of Himalayan region, India. Magadum *et al.* (2017) values of total phosphate ranged from 0.60mgl^{-1} to 0.800mgl^{-1} which supports the findings of the present study.

The values of phosphate throughout the study period were found to be within the permissible limits prescribed by BIS (2012).

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Table2: Water quality parameters at Kolar River

Parameters	Station							
	S1	S2	S3	S4	S5	S6	S7	S8
Air Temp (^{0}C)	28	28	28.9	27.6	28	27.5	26.5	27
Water Temp (^{0}C)	21.6	20.7	24.9	22.1	21.7	23.6	24.2	23.4
pH	8.5	7.8	8.2	8.3	8.4	7.0	8.1	7.8
EC (μS/cm)	390	390	485	420	119	390	380	420
TDS(ppm)	300	250	445	300	57	260	300	350
DO(mg/l)	7.0	7.9	8.4	8.9	9.0	12.8	8.6	8.7
Chloride(mg/l)	23.9	17.9	10.9	19.9	124.9	198	123	120.9
Nitrate	3.0	0.81	0.18	0.95	0.93	0.35	0.45	0.92
Phosphate	0.12	0.81	0.51	0.98	0.71	1.32	0.51	0.70

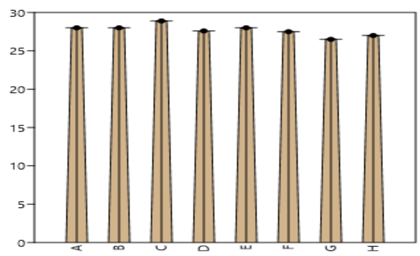

Fig-1: Variation in Air Temperature

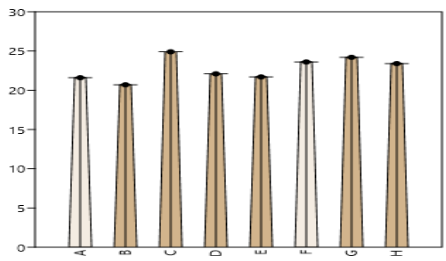

Fig-2: Variations in Water Temperature

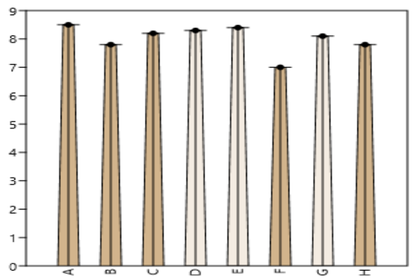

Fig-3: Shows Variation in pH

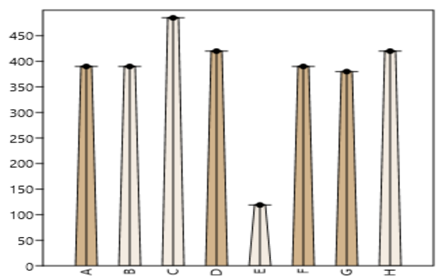

Fig-4: Shows Variation in Electrical Conductivity

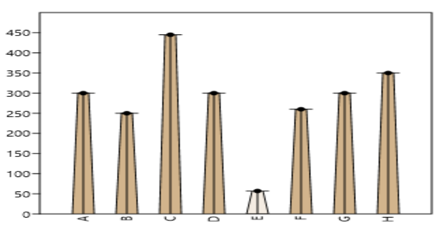

Fig-5: Shows Variation in TDS

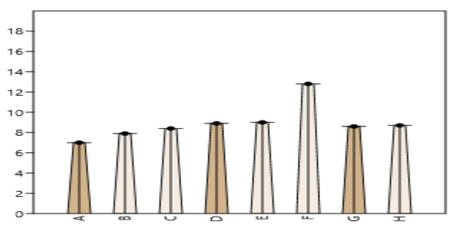

Fig-6: Shows variation in DO

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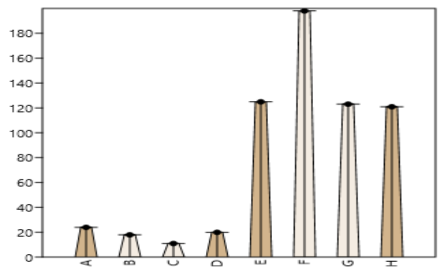

Fig-7: Shows Variation in Chloride

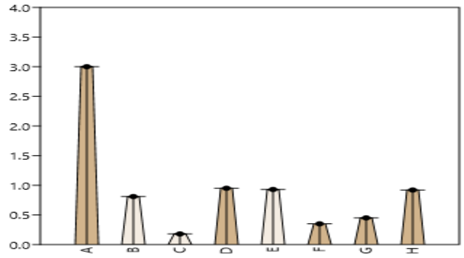

Fig-8: Shows variations in Nitrate

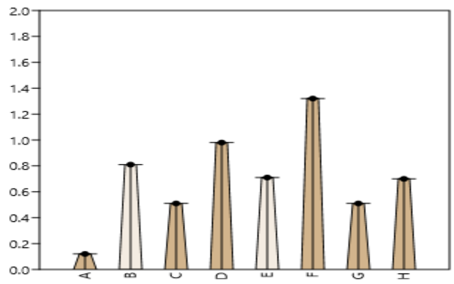

Fig-9: Shows Variations in Orthophosphate

Conclusion

Overall, the water from all the stations was found to be safe as drinking water. However, it is also important to investigate other potential water contaminations. In order to protect the environment in general and preserve a good water quality in particularly, especially of the Kolar River from MP, shared by two Districts and by so many communities, it is necessary to implement an adequate water management through the modern and efficient trends. The primary responsibility for water quality management lies with state and territory governments, which manage water supply and quality with the support of jurisdiction-specific guidelines, regulations, policies, processes and standards. Hence the Madhya Pradesh government should take measures to maintain the suitability of water in Kolar River.

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