Qualitative Analysis of Surface Water For Physico Chemical Parameters In Tungabhadra River

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Abstract- *Tungabhadra River is considered to be the holy river in India. In recent years, wide varities of pollutants have been reported to cause deterioration of water quality in rivers. A study was carried out for the assessment of physico chemical parameters in Tungbhadra river measured at 7 locations during December 2016 to April 2017. The physico chemical parameters such as Temperature, pH, EC, Turbidity, TSS, Hardness, Alkalinity, Calcium, Chloride, Sulphate, Fluoride, DO, COD were considered for testing the water quality conducted once in a month during the study period. The observed values of various parameters are compared with standard values recommended by IS 10500:2012. All the parameters recorded safe limits according to water quality standards except in case of Hardness, Calcium, Sulphate which exceeded the tolerance limit at few locations in particular month indicating river pollution. The fall in the quality of water in Tungabhadra river is due to sewage and effluent discharges, open defication, washing clothes and utensils, boating, fishing, religious ritual activities, natural occurance in earth, weathering of rocks, soil erosion, sand dredging that effect the water quality directly or indirectly. Continuous monitoring is required in order to protect the river from further pollution.*

Keywords- Tungabhadra River, Physico Chemical Parameters, Water Quality Standard, Pollution

I. INTRODUCTION

Water is vital resource and is essential for all forms of lives, from micro organisms to human beings **(Shukla et al., 2015).** Without water no life is possible to sustain on planet earth and hence it is termed as "Natural liquid Gold". Also water is termed as "universal solvent" as most of the chemicals gets dissolved in water **(Smitha et al., 2013).** In its pure form water is a boon but if polluted becomes poison for the living organisms **(Mishra, 2017).** On earth surface freshwater is available in the form of ice caps, glaciers, ponds, lakes, streams, rivers and as ground water resources. The most essential and vulnerable freshwater system is the river which plays a vital role in sustaining the life. In freshwater systems the decrease in the water quality threatens its sustainability and has become a cause for concern **(Smitha et al., 2013**). The condition of freshwater resources in India and their management as a serious environmental issue which includes agricultural waste, nutrition enrichment, acidification, sewage, industrial effluents and hazardous substances identified as major impacts. Water intended for human consumption must be free from excessive amount of minerals, organic matter and harmful micro organisms. Pollution of water is due to increased growth of population, expanding industrial growth, large scale urbanization, technological development, use of inorganic fertilizers in agriculture and man-made activities. Polluted water is a carrier of pathogenic micro organisms which cause immense harm to human population. The water quality is generally determined by its physico chemical characteristics. It is well established fact that pollutants in the form of agricultural runoff, solid waste disposal, mass bathing, disposing dead bodies, rural and urban wastes, industrial effluents discharged into natural water deteriorates the water quality **(Raja et al., 2008)**. The study taken up to assess Tungabhadra river water quality at selected points and thereby to suggest the remedies which requires regular monitoring.

II. MATERIALS AND METHODOLOGY

A. Study Area Description: Bhadra river and Tunga river meets at Koodli (Holehonnur town, Shimogga District, Karnataka) forming Tungabhadra river which flow down in the western ghats of Karnataka state. The journey of Bhadra river and Tunga river is 171 km and 147 km respectively till it reaches Koodli. Tungabhadra starts and flows through Karnataka state ultimately joining the river Krishna along the border of Telangana and Andhra Pradesh of India. River Tungabhadra is the largest tributary of river Krishna located in southern India. Tungabhadra river covers a distance of 531 km in which about 293 km flows in the state of Karnataka. The study undertaken at 7 different locations of river Tungabhadra covers river stretch of 105 km from upstream of Honnali to Mylara. The river Tungabhadra is polluted at various points due to effluents discharge, sewage disposal, anthropogenic activities etc.,

carried along the river bank. The study has been conducted to measure physico chemical parameters revealing river water quality at sampling locations.

B. Location of Sampling Stations: All the samples were collected along the left bank of Tungabhadra river. First sampling station is the Honnali Road bridge. New road bridge construction was undergoing parallel to the old bridge while the sample collected was near to old bridge. Second sampling station, located at New bridge in Kumarpattnam of Harihar. Third sampling station is the upstream of Harihar Polyfibre. The down stream of this sampling station consists of road bridge and railway bridge across the river. Fourth sampling station is located at Nadiharalhalli. Harihar town sewage disposal and effluent discharge takes place between third and fourth station. The sewage disposal of harihar town joins right bank of the river. The combined treated effluent from Harihara Poly Fibres and Grasilene Division joins near harihar at left bank of the river. Old water intake point is located in harihar. Jack well point is located at upstream of fourth sampling location Nadiharahalli. Fifth sampling location is Airani and it is a village located in Ranibennur of Haveri district. Airani Holemutt is located along the left river bank. Sixth sampling station is Hirebidri, Ranibennur taluk of Haveri district. Boating activity exists which transports people and light vehicles through water ways. Mylara being the seventh and the last sampling location considered in the study. Mylara Lingeswara temple is 2 km from the left bank of Tungbhadra river. Mylara village is located in Hoovina hadagali taluk of Bellary district.

Table 1: Details of Sampling Locations

Sl No.	Sampling Location	Longitude	Latitude
1	Honnali Bridge, Honnali	$14^0$12'N	$75^0$40'E
2	New Bridge, Kumarpatnam	$14^0$47'N	$75^0$76'E
3	U/S of HPF, Kumarpatnam	$14^0$53'N	$75^0$77'E
4	Nadiharalhalli	$14^0$51'N	$75^0$79'E
5	Airani	$14^0$56'N	$75^0$80'E
6	Hirebidri	$14^0$5'N	$75^0$81'E
7	Mylara	$14^0$76'N	$75^0$82'E

C. Sampling Procedure and Frequency: Grab samples were collected once in a month for all the selected sampling stations during the study period from December 2016 to April 2017 covering winter and summer seasons.

Table 2: Standards of Water Quality Parameters

Parameters	Prescribed Limits	Standards Considered	Instrument
Temperature, ^{0}C	15-35	WHO (2004)	Thermometer
COD, mg/l	10		COD Digestor
EC, µS/cm	300		pH Conducivty Apparatus
pH	6.5-8.5	IS (10500: 2012)	
Turbidity,NTU	1-5		Turbidity Meter
Chloride, mg/l	250-1000		Titration Assembly
Total Alkalinity,mg/l	200-600		
Total Hardness, mg/l	200-600		
Calcium, mg/l	75-200		
DO, mg/l	4-6		
Fluoride, mg/l	1-1.5		Spectrophotometer
Sulphate, mg/l	200-400		
TSS, mg/l	-		Filtration Apparatus

Grab samples collected at each point from a depth of about 20cm from surface of river Tungabhadra. Water was collected into clean polythene jerry cans of 2 litre capacity. Ensured no air bubble is inside the can and free from floating materials at the sampling locations. The details of the samples were mentioned on the lable, affixed on the can and kept in the ice box. Transferd it to the laboratory for further analysis which was done using well equipped instruments and considering standards (Table 2).

III. RESULTS AND DISCUSSIONS

The physico chemical tests were conducted employing standard scientific methods. Assessment of water samples for pollution is made by comparing with the corresponding standards prescribed for drinking water by various organizations IS and WHO as displayed in Table 2. Following are some of the observations revealed from the study of water quality parameters (Table 3). Graphical representation of the water quality parameters considered in the study are displayed in Figure 1 to 13.

Table 3: Estimation of Physico Chemical Parameters

Month/ Sampling Location	Dec	Jan	Feb	March	April
Temperature in ^{0}C					
Honnali Bridge, Honnali	25	25	25	28	27
New Bridge, Kumarpatnam	25	26	NF	NF	27
U/S of HPF,	26	26	NF	NF	27

Kumarpatnam					
Nadiharalhalli	26	27	29	NF	28
Airani	27	28	NF	NF	29
Hirebidri	28	28	NF	NF	29
Mylara	27	28	NF	NF	29
pH					
Honnali Bridge, Honnali	7.6	8	7.8	7.69	7.67
New Bridge, Kumarpatnam	7.8	8	NF	NF	8.3
U/S of HPF, Kumarpatnam	7.8	7.9	NF	NF	8.32
Nadiharalhalli	7.9	7.5	8.15	NF	8.23
Airani	8.1	7.9	NF	NF	7.83
Hirebidri	8.2	8	NF	NF	8.3
Mylara	8.2	8.1	NF	NF	8.36
Electrical Conductivity in µS/cm					
Honnali Bridge, Honnali	170	220	220	159	130
New Bridge, Kumarpatnam	230	290	NF	NF	140
U/S of HPF, Kumarpatnam	230	360	NF	NF	140
Nadiharalhalli	480	880	2700	NF	170
Airani	440	650	NF	NF	160
Hirebidri	430	650	NF	NF	150
Mylara	390	560	NF	NF	170
Turbidity in NTU					
Honnali Bridge, Honnali	2	2	3	2	1
New Bridge, Kumarpatnam	1	1	NF	NF	1
U/S of HPF, Kumarpatnam	1	1	NF	NF	2
Nadiharalhalli	3	3	5	NF	2
Airani	2	2	NF	NF	2
Hirebidri	2	2	NF	NF	1
Mylara	3	3	NF	NF	1
Total Suspended Solids in mg/l					
Honnali Bridge, Honnali	6	48	20	24	10
New Bridge, Kumarpatnam	12	8	NF	NF	12
U/S of HPF, Kumarpatnam	12	10	NF	NF	14
Nadiharalhalli	74	22	52	NF	16
Airani	57	16	NF	NF	24
Hirebidri	20	14	NF	NF	8
Mylara	50	18	NF	NF	12
Total Hardness in mg/l					
Honnali Bridge, Honnali	58	70	94	52	48
New Bridge, Kumarpatnam	82	106	NF	NF	52
U/S of HPF, Kumarpatnam	82	114	NF	NF	52
Nadiharalhalli	136	200	720	NF	52
Airani	132	176	NF	NF	48
Hirebidri	132	178	NF	NF	54
Mylara	116	154	NF	NF	48
Total Alkalinity in mg/l					
Honnali Bridge, Honnali	76	84	84	58	50
New Bridge, Kumarpatnam	100	100	NF	NF	54
U/S of HPF, Kumarpatnam	124	114	NF	NF	56
Nadiharalhalli	136	136	188	NF	54
Airani	136	132	NF	NF	54
Hirebidri	152	134	NF	NF	48
Mylara	136	160	NF	NF	68
Calcium in mg/l					
Honnali Bridge, Honnali	34	38	52	28	26
New Bridge, Kumarpatnam	48	72	NF	NF	28
U/S of HPF, Kumarpatnam	48	72	NF	NF	30
Nadiharalhalli	86	148	380	NF	28
Airani	78	118	NF	NF	26
Hirebidri	74	104	NF	NF	28
Mylara	70	108	NF	NF	26
Chloride in mg/l					
Honnali Bridge, Honnali	44	28	34	22	20
New Bridge, Kumarpatnam	30	46	NF	NF	20
U/S of HPF, Kumarpatnam	32	60	NF	NF	20
Nadiharalhalli	74	128	390	NF	24
Airani	62	84	NF	NF	18
Hirebidri	60	84	NF	NF	18
Mylara	54	88	NF	NF	20
Sulphate in mg/l					
Honnali Bridge, Honnali	6	8	16	8	5
New Bridge, Kumarpatnam	12	21	NF	NF	13
U/S of HPF, Kumarpatnam	12	27	NF	NF	13

Nadiharalhalli	74	240	550	NF	28
Airani	57	106	NF	NF	27
Hirebidri	50	128	NF	NF	24
Mylara	50	70	NF	NF	25
Fluoride in mg/l					
Honnali Bridge, Honnali	0.22	0.22	0.26	0.03	0.31
New Bridge, Kumarpatnam	0.31	0.41	NF	NF	0.29
U/S of HPF, Kumarpatnam	0.3	0.53	NF	NF	0.28
Nadiharalhalli	0.65	0.68	0.71	NF	0.4
Airani	0.55	0.66	NF	NF	0.42
Hirebidri	0.4	0.66	NF	NF	0.35
Mylara	0.39	0.45	NF	NF	0.28
Dissolved Oxygen in mg/l					
Honnali Bridge, Honnali	7	7.1	7	7.2	7.2
New Bridge, Kumarpatnam	7.6	7.6	NF	NF	7.2
U/S of HPF, Kumarpatnam	7.5	7.5	NF	NF	7.3
Nadiharalhalli	5.9	4.8	4.6	NF	6.8
Airani	6	6.9	NF	NF	7
Hirebidri	6.2	7.1	NF	NF	7.1
Mylara	7.1	7.6	NF	NF	7.4
Chemical Oxygen Demand in mg/l					
Honnali Bridge, Honnali	39	27	43	29	19
New Bridge, Kumarpatnam	14	19	NF	NF	21
U/S of HPF, Kumarpatnam	15	23	NF	NF	18
Nadiharalhalli	62	86	100	NF	22
Airani	45	36	NF	NF	29
Hirebidri	43	27	NF	NF	18
Mylara	46	28	NF	NF	28

Note: NF-No Flow

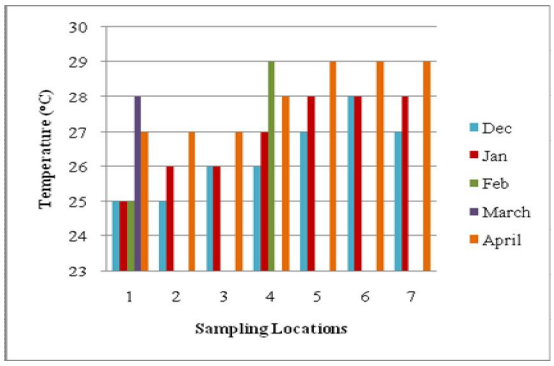

Figure 1: Graphical Representation of Temperature

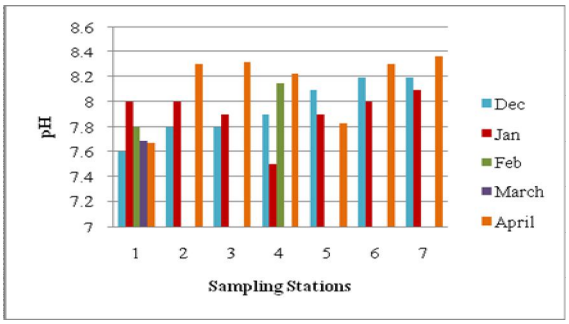

Figure 2: Graphical Representation of pH

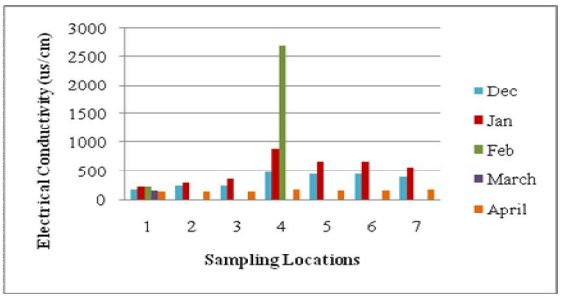

Figure 3: Graphical Representation of Electrical Conductivity

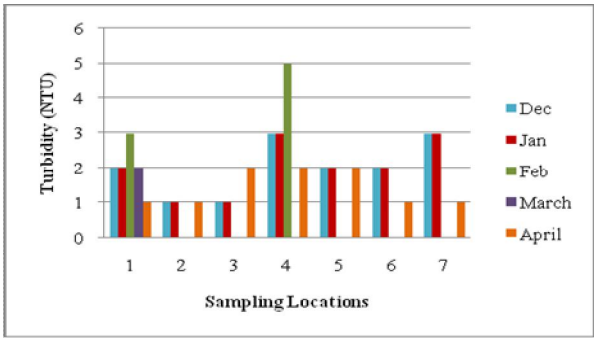

Figure 4: Graphical Representation of Turbidity

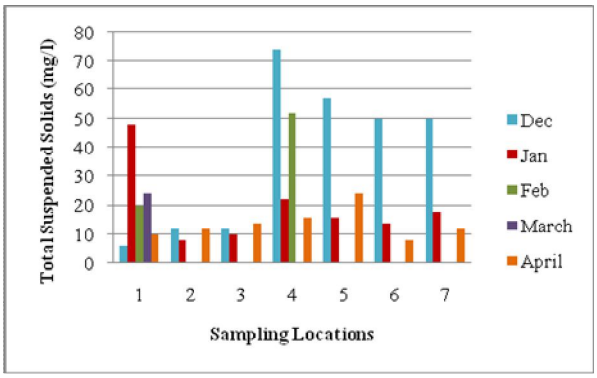

Figure 5: Graphical Representation of Total Suspended Solids

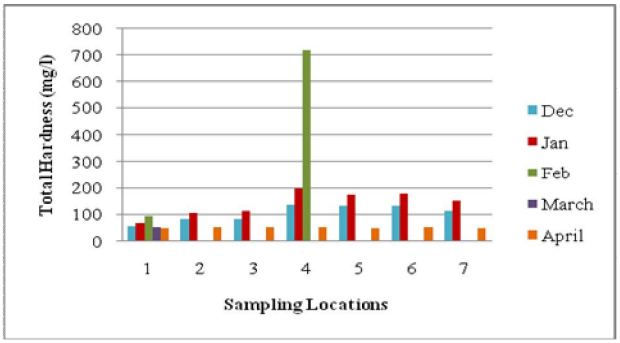

Figure 6: Graphical Representation of Total Hardness

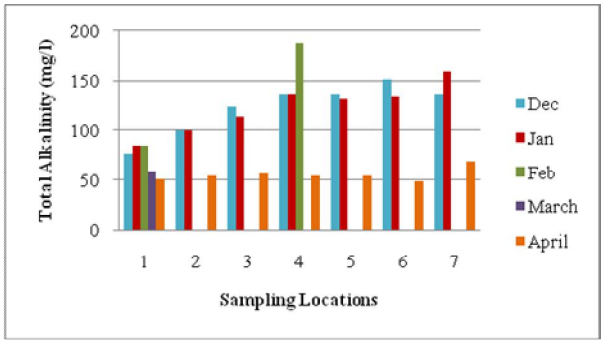

Figure 7: Graphical Representation of Total Alkalinity

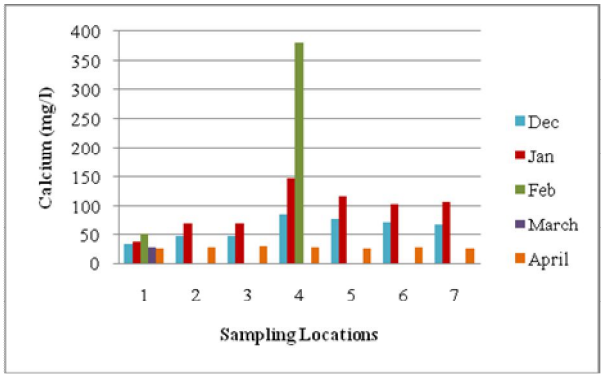

Figure 8: Graphical Representation of Calcium

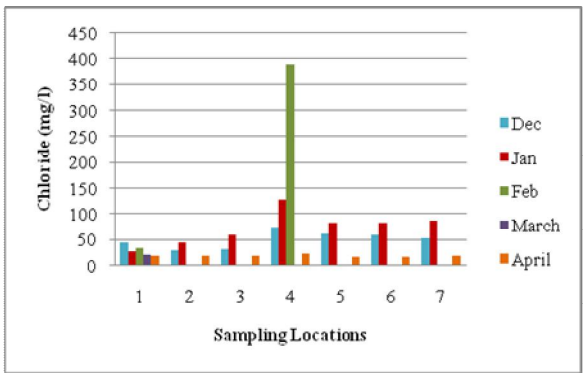

Figure 9: Graphical Representation of Chloride

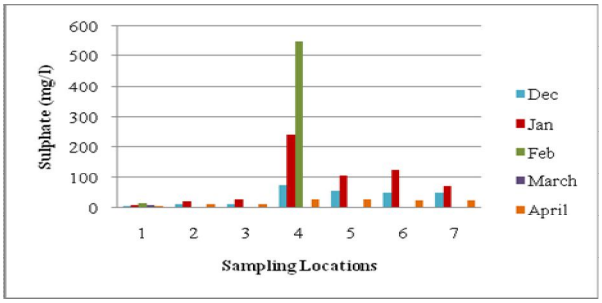

Figure 10: Graphical Representation of Sulphate

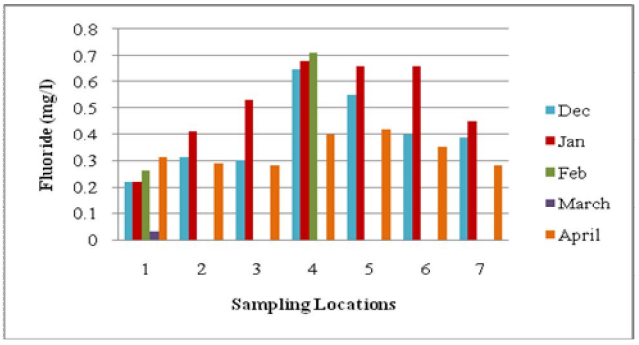

Figure 11: Graphical Representation of Fluoride

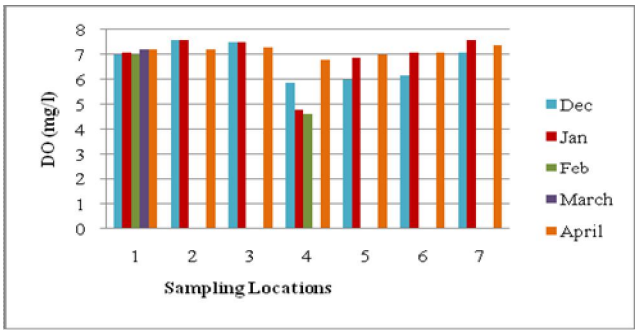

Figure 12: Graphical Representation of Dissolved Oxygen

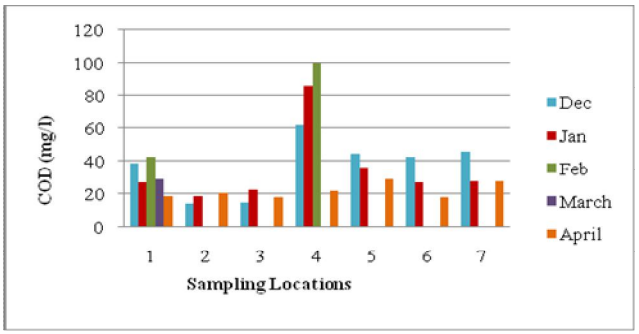

Figure 13: Graphical Representation of Chemical Oxygen Demand

IV. CONCLUSIONS

The physico chemical analysis in Tungabhadra river conducted during the study derives the pollution extent which helps in ensuring safety to public health and aquatic life.

1. The sources of pollution in Tungabhadra river observed during the study is due to domestic and municipal wastes, effluent discharges, siltation, erosion of natural deposits, soil leaching, direct atmospheric deposition and increased anthropogenic activities.
2. During the study period No flow was recorded at locations 2, 3, 5, 6, 7 in the month of February and at locations 2, 3, 4, 5, 5 ,7 in the month of March due to summer season with high temperature causing evaporation loses leading to lean river flow or no flow.
3. The water quality analysis of pH, Turbidity, Chloride, Total Alkalinity, DO and Fluoride showed safe limits according to Bureau of Indian Standards during the study period.
4. The parameters such as Total Hardness, Calcium and Sulphate fall within the BIS limits with one exceptional sampling station i.e location 4, Nadiharalhalli recorded excess value in the month of February.
5. The other physico chemical parameters such as COD exceeded the WHO standard limit at all locations indicating high content of non biodegradable matter. Conductivity exceeded the WHO standard limits at location 4, 5, 6, 7(Dec), location 3, 4, 5, 6, 7(Jan) and location 4(Feb). Solids recorded its highest value at location 4 in the month of December.
6. Temperature varied according to atmospheric conditions and showed safe limits as per WHO standards.
7. It is observed from the study that location 1, Honnali Bridge, Honnali i.e upstream of Tungabhadra river is least polluted. The pollution in river water gradually increases as the flow continues down stream i.e towards location 2, 3 and 4.
8. The location 4, Nadiharalhalli has the highest pollution level due to sewage and effluent discharges along with increased anthropogenic activites.
9. Further the pollution level gets decreased at location 5 and 6 due to no interruption of toxic discharges. Location 7, Mylara posses low pollution level due to the self purification of river implying moderately polluted.
10. On the whole Tungabhadra river water quality holds good and can be used for drinking purpose excluding the exceptional values recorded at particular location and time as specified in the present study. Exceeding values indicates high organic pollution and demand treatment.

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